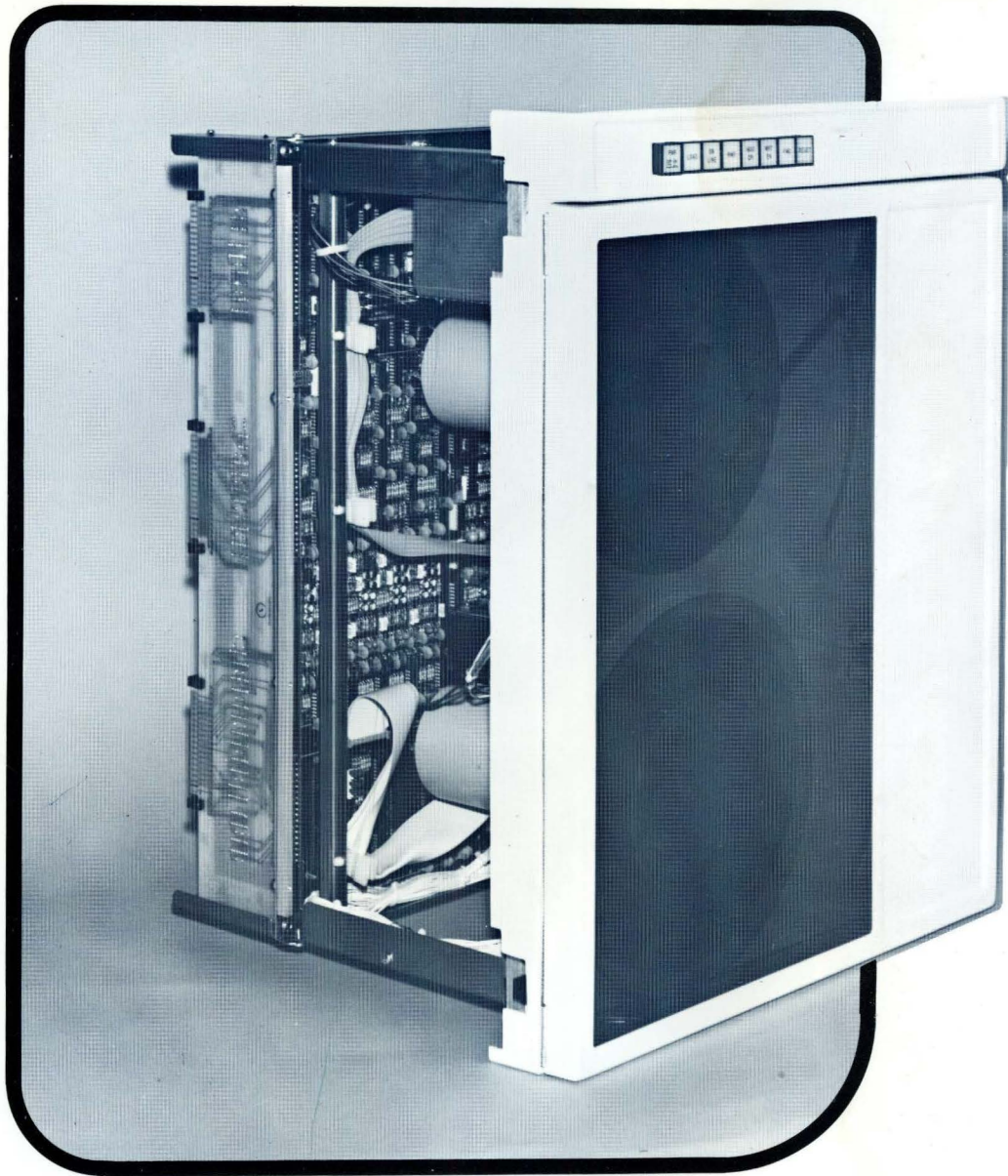


# TANDBERG

## TDI 1050 SERIES SYNCHRONOUS TAPE TRANSPORT



### OPERATION AND MAINTENANCE INSTRUCTIONS

**TANDBERG DATA INC.**

4060 Morena Boulevard • San Diego, California 92117 • Telephone: (714) 270-3990 • TWX: (910) 335-1610

TECHNICAL MANUAL

PUBLICATION NO. 00-10001

## TECHNICAL MANUAL

## OPERATION AND MAINTENANCE INSTRUCTIONS

# TDI 1050 Series Synchronous Tape Transport

MODEL 1050 – STANDARD DRIVE / NO INTERFACE ADAPTER

MODEL 1051 – STANDARD DRIVE / STANDALONE OR LAST

MODEL 1052 – DRIVE / INTERMEDIATE

MODEL 1053 – DRIVE / MASTER / FORMATTER

MODEL 1054 – DRIVE / FORMATTER / STANDALONE

CUSTOMER \_\_\_\_\_

Contract No. \_\_\_\_\_

Customer Part No. \_\_\_\_\_

TDI Part No. \_\_\_\_\_

Serial No. \_\_\_\_\_

Shipping Date \_\_\_\_\_

☐ STANDARD☐ SPECIAL

SEE CUSTOMER OPTION SECTION

**TANDBERG DATA INC.**

4060 Morena Boulevard • San Diego, California 92117 • Tel: (714) 270-3990 • TWX: (910) 335-1610

## NOTICE

THIS MATERIAL IS THE PROPERTY OF TANDBERG DATA, INC. (TDI) IT IS FURNISHED AS AN AID IN THE OPERATION AND MAINTENANCE OF TDI PRODUCTS ONLY AND ITS REPRODUCTION OR USE IN ANY OTHER WAY OR FOR ANY COMMERCIAL PURPOSE WITHOUT PRIOR WRITTEN PERMISSION OF TDI IS FORBIDDEN. ALL RIGHTS TO THIS MATERIAL ARE RESERVED.

## LIST OF EFFECTIVE PAGES

Total number of pages in this manual is \_\_\_\_\_ consisting of the following:

| Page #        | Change# | Page #         | Change# |
|---------------|---------|----------------|---------|
| Title         |         | 6-1 thru 6-24  |         |
| Notice        |         | 7-1 thru 7-15  |         |
| A thru B      |         | 8-1 thru 8-15  |         |
| i thru ix     |         | 9-1 thru 9-3   |         |
| 1-0 thru 1-20 |         | 10-1 thru 10-1 |         |
| 2-0 thru 2-26 |         | A-1 thru A-7   |         |
| 3-1 thru 3-7  |         | B-1            |         |
| 4-1 thru 4-16 |         | C-1            |         |
| 5-1 thru 5-5  |         |                |         |



[illegible]

B

## TABLE OF CONTENTS

| Paragraph                |                                                                            | Page |
|--------------------------|----------------------------------------------------------------------------|------|
| SECTION I - INTRODUCTION |                                                                            |      |
| 1.1                      | GENERAL DESCRIPTION . . . . .                                              | 1-1  |
| 1.2                      | PHYSICAL DESCRIPTION . . . . .                                             | 1-3  |
| 1.2.1                    | Top Plate . . . . .                                                        | 1-3  |
| 1.2.2                    | Capstan Motor . . . . .                                                    | 1-4  |
| 1.2.3                    | Reel Motors . . . . .                                                      | 1-4  |
| 1.2.4                    | Retractor Motor . . . . .                                                  | 1-6  |
| 1.2.5                    | Compliance Arm Assembly . . . . .                                          | 1-6  |
| 1.2.6                    | Supply Reel Hub . . . . .                                                  | 1-6  |
| 1.2.7                    | Take-Up Reel . . . . .                                                     | 1-6  |
| 1.2.8                    | Roller Guides . . . . .                                                    | 1-6  |
| 1.2.9                    | Crowned Roller Guides . . . . .                                            | 1-8  |
| 1.2.10                   | Capstan Drive Wheel . . . . .                                              | 1-8  |
| 1.2.11                   | Head Guides . . . . .                                                      | 1-8  |
| 1.2.12                   | Head Assembly . . . . .                                                    | 1-9  |
| 1.2.13                   | Electronics . . . . .                                                      | 1-9  |
| 1.2.14                   | TDF 4050 Formatter (Optional) . . . . .                                    | 1-11 |
| 1.2.15                   | Power Supply and Voltage Regulators . . . . .                              | 1-11 |
| 1.3                      | FUNCTIONAL DESCRIPTION OF BASIC TDI 1050 DRIVE . . . . .                   | 1-12 |
| 1.3.1                    | Write Electronics . . . . .                                                | 1-12 |
| 1.3.2                    | Read Electronics . . . . .                                                 | 1-12 |
| 1.3.3                    | Control Logic . . . . .                                                    | 1-12 |
| 1.3.4                    | Power Fail . . . . .                                                       | 1-14 |
| 1.3.5                    | I/O Connectors . . . . .                                                   | 1-14 |
| 1.4                      | DATA FORMATTING . . . . .                                                  | 1-14 |
| 1.5                      | OPTIONS . . . . .                                                          | 1-14 |
| 1.5.1                    | Options Available at Time of Order . . . . .                               | 1-14 |
| 1.5.2                    | Options Available Through Switch Settings<br>or Jumper Placement . . . . . | 1-19 |

## TABLE OF CONTENTS (Continued)

| Paragraph                              |                                                     | Page |
|----------------------------------------|-----------------------------------------------------|------|
| SECTION II - INSTALLATION AND HANDLING |                                                     |      |
| 2.1                                    | INTRODUCTION . . . . .                              | 2-1  |
| 2.2                                    | PHYSICAL DESCRIPTION . . . . .                      | 2-1  |
| 2.3                                    | ACCEPTANCE OF DELIVERY . . . . .                    | 2-2  |
| 2.4                                    | UNPACKING INSTRUCTIONS . . . . .                    | 2-2  |
| 2.5                                    | RECEIVING INSPECTION . . . . .                      | 2-4  |
| 2.6                                    | SPACE, ENVIRONMENT AND POWER REQUIREMENTS . . . . . | 2-4  |
| 2.6.1                                  | Space Requirements . . . . .                        | 2-4  |
| 2.6.2                                  | Environment . . . . .                               | 2-5  |
| 2.6.3                                  | Power . . . . .                                     | 2-5  |
| 2.7                                    | INITIAL CHECKOUT PROCEDURE . . . . .                | 2-5  |
| 2.7.1                                  | Primary Power Application . . . . .                 | 2-5  |
| 2.7.2                                  | Initial Check Out . . . . .                         | 2-6  |
| 2.8                                    | MOUNTING PROCEDURE . . . . .                        | 2-9  |
| 2.9                                    | INTERFACE . . . . .                                 | 2-13 |
| 2.9.1                                  | Interface Description . . . . .                     | 2-13 |
| 2.9.2                                  | Drive Interface . . . . .                           | 2-15 |
| 2.9.3                                  | Drive Interface Description . . . . .               | 2-17 |
| 2.10                                   | INTERNAL SWITCH AND JUMPERS . . . . .               | 2-23 |
| 2.11                                   | RESHIPMENT . . . . .                                | 2-25 |
| 2.12                                   | SUBSTITUTE SHIPPING CONTAINER . . . . .             | 2-26 |
| SECTION III - OPERATIONS               |                                                     |      |
| 3.1                                    | INTRODUCTION . . . . .                              | 3-1  |
| 3.2                                    | CONTROLS AND INDICATORS . . . . .                   | 3-1  |
| 3.3                                    | TAPE LOADING PROCEDURE . . . . .                    | 3-4  |
| 3.3.1                                  | To Load Tape . . . . .                              | 3-5  |
| 3.3.2                                  | Advancing Tape to Load Point . . . . .              | 3-5  |
| 3.3.3                                  | Tape Removal Procedure . . . . .                    | 3-5  |

## TABLE OF CONTENTS (Continued)

| Paragraph                            |                                                              | Page |
|--------------------------------------|--------------------------------------------------------------|------|
| SECTION IV - THEORY OF OPERATION     |                                                              |      |
| 4.1                                  | INTRODUCTION . . . . .                                       | 4-1  |
| 4.2                                  | DESCRIPTION . . . . .                                        | 4-1  |
| 4.3                                  | POWER SUPPLY . . . . .                                       | 4-4  |
| 4.4                                  | CAPSTAN DRIVE . . . . .                                      | 4-4  |
| 4.5                                  | REEL DRIVE . . . . .                                         | 4-7  |
| 4.6                                  | CONTROL ELECTRONICS . . . . .                                | 4-8  |
| 4.7                                  | DATA ELECTRONICS . . . . .                                   | 4-15 |
| SECTION V - PREVENTATIVE MAINTENANCE |                                                              |      |
| 5.1                                  | INTRODUCTION . . . . .                                       | 5-1  |
| 5.2                                  | PREVENTATIVE MAINTENANCE SCHEDULE . . . . .                  | 5-1  |
| 5.3                                  | TAPE CLEANER HEAD ASSEMBLY AND TAPE GUIDE CLEANING . . . . . | 5-2  |
| 5.4                                  | CAPSTAN CLEANING . . . . .                                   | 5-2  |
| 5.5                                  | HOUSING AND DUST COVER CLEANING . . . . .                    | 5-5  |
| SECTION VI - MAINTENANCE             |                                                              |      |
| 6.1                                  | INTRODUCTION . . . . .                                       | 6-1  |
| 6.2                                  | FUSE REPLACEMENT . . . . .                                   | 6-3  |
| 6.3                                  | TAPE PATH ALIGNMENT . . . . .                                | 6-3  |
| 6.4                                  | REMOVAL AND REPLACEMENT . . . . .                            | 6-10 |
| 6.4.1                                | Dust Door . . . . .                                          | 6-10 |
| 6.4.2                                | Read/Write Head Subassembly . . . . .                        | 6-11 |
| 6.4.3                                | BOT/EOT Sensor . . . . .                                     | 6-12 |
| 6.4.4                                | Roller Guides . . . . .                                      | 6-12 |
| 6.4.5                                | Hubs . . . . .                                               | 6-13 |
| 6.4.6                                | Capstan Sleeves . . . . .                                    | 6-15 |
| 6.4.7                                | Front Panel Switches . . . . .                               | 6-15 |
| 6.4.8                                | Take-Up Motor (Upper) . . . . .                              | 6-16 |
| 6.4.9                                | Supply Motor (Lower) . . . . .                               | 6-16 |
| 6.4.10                               | Capstan Motor . . . . .                                      | 6-16 |

## TABLE OF CONTENTS (Continued)

| Paragraph                      |                                                           | Page |
|--------------------------------|-----------------------------------------------------------|------|
| 6.4.11                         | Compliance Arms . . . . .                                 | 6-18 |
| 6.4.12                         | Compliance Arm Retractor . . . . .                        | 6-20 |
| 6.4.13                         | Power Supply . . . . .                                    | 6-20 |
| 6.4.14                         | Main Transformer . . . . .                                | 6-21 |
| 6.4.15                         | Main Electronic Board . . . . .                           | 6-21 |
| SECTION VII - TESTING          |                                                           |      |
| 7.1                            | GENERAL . . . . .                                         | 7-1  |
| 7.2                            | DIAGNOSTIC TEST PROCEDURES . . . . .                      | 7-3  |
| 7.2.1                          | Test Mode Set-Up . . . . .                                | 7-4  |
| 7.2.2                          | Test Group One - Basic Transport Adjustments . . . . .    | 7-6  |
| 7.2.3                          | Test Group Two - Repetitive Transport Exercises . . . . . | 7-7  |
| 7.2.4                          | Test Group Three - Operational Pass/Fail Test . . . . .   | 7-8  |
| 7.3                            | OPERATIONAL TESTS . . . . .                               | 7-10 |
| 7.3.1                          | Voltage Checks . . . . .                                  | 7-10 |
| 7.3.2                          | Sensor Checks . . . . .                                   | 7-10 |
| 7.3.3                          | Take-Up Arm Adjustments . . . . .                         | 7-12 |
| 7.3.4                          | Supply Arm Adjustments . . . . .                          | 7-12 |
| 7.3.5                          | Arm Limit Adjustments . . . . .                           | 7-13 |
| 7.3.6                          | Operational Checks . . . . .                              | 7-14 |
| SECTION VIII - TROUBLESHOOTING |                                                           |      |
| 8.1                            | INTRODUCTION . . . . .                                    | 8-1  |
| 8.2                            | COMMON PROBLEMS . . . . .                                 | 8-2  |
| 8.3                            | SYSTEM TROUBLESHOOTING . . . . .                          | 8-2  |
| 8.4                            | TROUBLESHOOTING WITH OFF-LINE DIAGNOSTIC TESTS . . . . .  | 8-2  |
| 8.5                            | TEST POINT CHARTS . . . . .                               | 8-2  |
| 8.6                            | CIRCUIT BOARD ADJUSTMENTS . . . . .                       | 8-2  |
| SECTION IX - DIAGRAMS          |                                                           |      |
| 9.1                            | INTRODUCTION . . . . .                                    | 9-1  |
| 9.2                            | LOGIC SYMBOLS . . . . .                                   | 9-1  |

## TABLE OF CONTENTS (Continued)

| Paragraph                                           |                           | Page |
|-----------------------------------------------------|---------------------------|------|
| 9.3                                                 | DIAGRAM LISTING . . . . . | 9-3  |
| SECTION X - SERVICE BULLETINS/APPLICATION NOTES     |                           |      |
| 10.1                                                | INTRODUCTION. . . . .     | 10-1 |
| APPENDIX A - GLOSSARY                               |                           |      |
| APPENDIX B - CUSTOMER OPTIONS                       |                           |      |
| APPENDIX C - TDF FORMATTER (If unit is so equipped) |                           |      |



## LIST OF ILLUSTRATIONS

| Figure | Title                                                           | Page    |
|--------|-----------------------------------------------------------------|---------|
| 1-1    | Digital Magnetic Tape Transport Mod 1050 Series . . . . .       | 1-0     |
| 1-2    | Master/Slave Configuration . . . . .                            | 1-2     |
| 1-3    | Tape Transport Drive Motors & Electronics . . . . .             | 1-5     |
| 1-4    | Tape Transport Front Panel Components . . . . .                 | 1-7     |
| 1-5    | Headplate Assembly Details . . . . .                            | 1-10    |
| 1-6    | Functional Block Diagram, TDI 1050 . . . . .                    | 1-13    |
| 1-7    | Phase Encoded Tape Format . . . . .                             | 1-15    |
| 1-8    | NRZI Tape Format . . . . .                                      | 1-16    |
| 1-9    | Tape Organization . . . . .                                     | 1-17/18 |
| 2-1    | Dimensional Outline . . . . .                                   | 2-0     |
| 2-2    | Control Panel . . . . .                                         | 2-1     |
| 2-3    | Outer Carton . . . . .                                          | 2-3     |
| 2-4    | Inner Carton Open . . . . .                                     | 2-3     |
| 2-5    | Removal of Inner Carton . . . . .                               | 2-3     |
| 2-6    | Input Power Voltage Selection . . . . .                         | 2-7     |
| 2-7    | Label Locations on TDI 1050 Series . . . . .                    | 2-8     |
| 2-8    | Mounting Details TDI 1050 Series . . . . .                      | 2-11    |
| 2-9    | Transport Mounting Safety Block and Interface Details . . . . . | 2-12    |
| 2-10   | User and/or TDI Drivers and Receivers . . . . .                 | 2-14    |
| 3-1    | Controls and Indicators . . . . .                               | 3-1     |
| 3-2    | Magnetic Tape Path During Threading . . . . .                   | 3-6     |
| 4-1    | Capstan Servo Wave Forms . . . . .                              | 4-6     |
| 4-2    | TDI 1050 Control . . . . .                                      | 4-9/10  |
| 4-3    | Microprocessor I/O Functions . . . . .                          | 4-11    |
| 4-4    | Program Flow, On Line . . . . .                                 | 4-12    |
| 5-1    | Cleaning Points . . . . .                                       | 5-2/3   |
| 6-1    | Tape Path Components . . . . .                                  | 6-4/5   |
| 6-2    | Rear Panel Location . . . . .                                   | 6-17    |
| 6-3    | Main Electronic Board . . . . .                                 | 6-22    |

## LIST OF TABLES

| Table | Title                                                                                | Page |
|-------|--------------------------------------------------------------------------------------|------|
| 1.1   | Tape Speeds . . . . .                                                                | 1-3  |
| 2.1   | Line Voltage/Fuse Selection . . . . .                                                | 2-6  |
| 2.2   | Channel Identification Comparison . . . . .                                          | 2-13 |
| 2.3   | Interface Connector Pin Assignments, TDI 1051, 1052<br>Controls and Status . . . . . | 2-15 |
| 2.4   | Standard TDI 1051, 1052 Dip Switch Functions . . . . .                               | 2-24 |
| 2.5   | Main Electronics Board Jumper Functions . . . . .                                    | 2-25 |
| 3.1   | Control and Indicator Functions . . . . .                                            | 3-2  |
| 4.1   | Mechanical and Electrical Specifications . . . . .                                   | 4-2  |
| 5.1   | Preventative Maintenance Schedule . . . . .                                          | 5-1  |
| 6.1   | Recommended Tools for Maintenance . . . . .                                          | 6-2  |
| 6.2   | Read Amplifier Parameters . . . . .                                                  | 6-8  |
| 6.3   | Recommended Spare Parts Kit . . . . .                                                | 6-23 |
| 6.4   | Supplementary Spare Parts List . . . . .                                             | 6-24 |
| 7.1   | Self-Test Selection . . . . .                                                        | 7-2  |
| 7.2   | Diagnostic-Tests Selection . . . . .                                                 | 7-3  |
| 7.3   | Standard Configuration Jumpers Installed . . . . .                                   | 7-4  |
| 7.4   | Diagnostic Test Controls . . . . .                                                   | 7-5  |
| 8.1   | Common Problems . . . . .                                                            | 8-3  |
| 8.2   | System Troubleshooting . . . . .                                                     | 8-6  |
| 8.3   | Troubleshooting Chart . . . . .                                                      | 8-9  |
| 8.4   | Test Point Chart . . . . .                                                           | 8-10 |
| 8.5   | TDI 1050 Circuit Board Adjustments . . . . .                                         | 8-14 |
| 9.1   | Logic Symbology and Truth Tables . . . . .                                           | 9-1  |
| 9.2   | D-Type Flipflop . . . . .                                                            | 9-2  |
| 9.3   | JK Flipflop . . . . .                                                                | 9-2  |

## FORWARD

THIS DOCUMENT CONTAINS INFORMATION REQUIRED BY PERSONNEL AT ALL LEVELS OF INVOLVEMENT TO UNDERSTAND FUNCTIONS, INTERNAL OPERATIONS, AND MAINTENANCE REQUIREMENTS OF THE TANDBERG DATA, INC. MODEL 1050 SYNCHRONOUS TAPE TRANSPORTS.

THE INFORMATION PRESENTED PERTAINS TO THE STANDARD MODEL 1050. CERTAIN PARAMETERS AND SPECIFICATIONS PECULIAR TO THE SPECIFIC PART NUMBERS AND SERIAL NUMBERS DESIGNATED ON THE TITLE PAGE ARE DISCUSSED IN APPENDIX B, CUSTOMER OPTIONS.

## WARRANTY AND ASSISTANCE

All Tandberg Data, Inc products are warranted against defects in materials and workmanship for a period of one year after delivery. Warranty obligation is limited to the repair of equipment or replacement of components which prove to be defective on units returned to the factory for warranty service. Any repairs and/or replacement of components after the warranty period are warranted for a period of Ninety (90) days. All units must be returned to factory for service and warranty considerations.

Certain limited procedures listed under Removal and Replacement of Parts and Subassemblies in Section VI - Maintenance, of the manual, may be performed by competent customer personnel with the expressed permission of TDI. Beyond these limited procedures the opening, alteration or repair of the equipment except by (1) TDI personnel or (2) TDI trained customer personnel will void the Warranty. TDI is not liable for incidental or consequential damage. No other warranty is expressed or implied. If any question or confusion arises concerning warranty, the TDI master warranty shall take precedence.

When information, assistance or authorization is required, refer to the specific model, part number and serial number of unit when contacting the Manager of Customer Service, Tandberg Data, Inc. at 714/270-3990.

**TANDBERG**

**SECTION I  
INTRODUCTION**

**PUBLICATION NO. 00-10001**

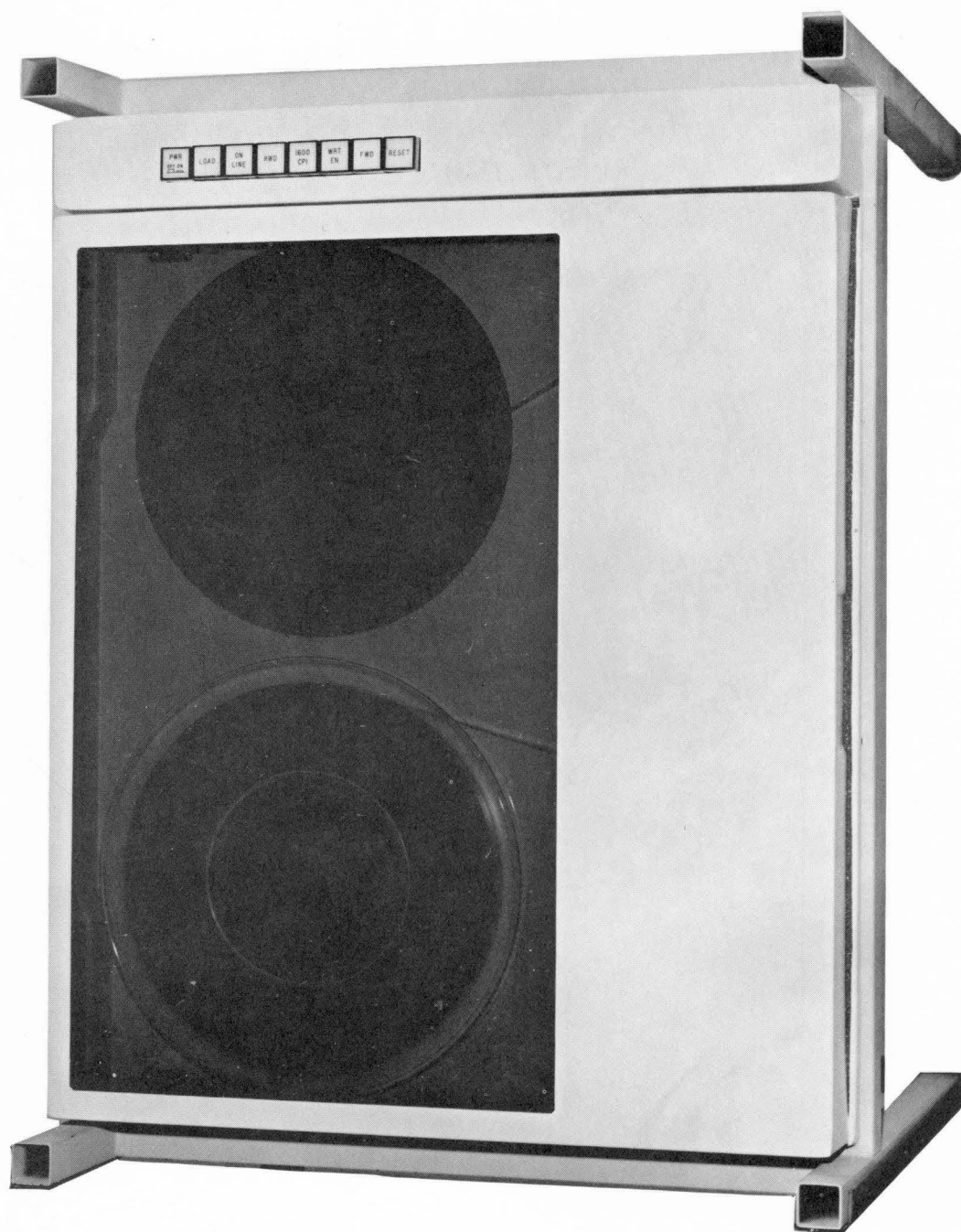


FIGURE 1-1. DIGITAL MAGNETIC TAPE TRANSPORT MODEL 1050 SERIES

## SECTION I

### INTRODUCTION

This section contains general information relating to the Tandberg, Data, Inc. Model TDI 1050 Series Synchronous Tape Transports. Included in this section are a general description, physical description, and functional description. An outline of the options appears at the end of the section.

#### 1.1 GENERAL DESCRIPTION

The Tandberg Data, Inc. Model 1050 Series of Synchronous Tape Transports consist of industry-compatible half-inch magnetic tape drives, formatter, interface adapters and interconnecting cables. The TDI 1050 series drive is a compliance-arm buffered, 12.5 ips - 45 ips, dual-format (NRZI/PE), 10.5 inch machine of the newest design available today.

The TDI 1050 Series consists of the following models:

- Model 1050 Standard Drive/No Interface Adapter
- Model 1051 Standard Drive/Stand-alone or Last Unit
- Model 1052 Standard Drive/Intermediate Unit
- Model 1053 Standard Drive/Formatter/Master Unit
- Model 1054 Standard Drive/Formatter/Stand-alone Unit

The above models, used in various configurations, will produce tape drive systems from a single non-formatted drive to multiple drive systems, including tape formatting for generation and reading of ANSI, IBM and ECMA - compatible tapes. The formatted version is designed to work with 9-track 1600 bpi PE and 800 bpi NRZI tape drives and 7-track 200/556/800 bpi NRZI tape drives.

All components of the above systems are contained within the package envelope of the basic tape drive, with the exception of the interconnecting cables required to interface with the system.

The functional objective of the TDI 1050 series is to provide easy system configuration by means of compatible and interchangeable modules, consisting of industry standard tape transports, interface boards, formatter electronics (TDF 4050) and associated cabling. Any TDI 1050 unit can be easily configured from the basic drive mechanism (Model 1050) to master drive arrangement (Model 1053), consisting of the transport mechanism, interface board, TDF 4050 formatter, and daisy-chain capabilities.

Two typical systems are shown in Figure 1-2. One is a minimal single non-formatted drive and the other is comprised of a master tape drive with integral formatter (Model 1053); up to three slave tape drives (Model 1051/1052); interface adapter, and associated cables. The interfaces are industry compatible for either system configuration.

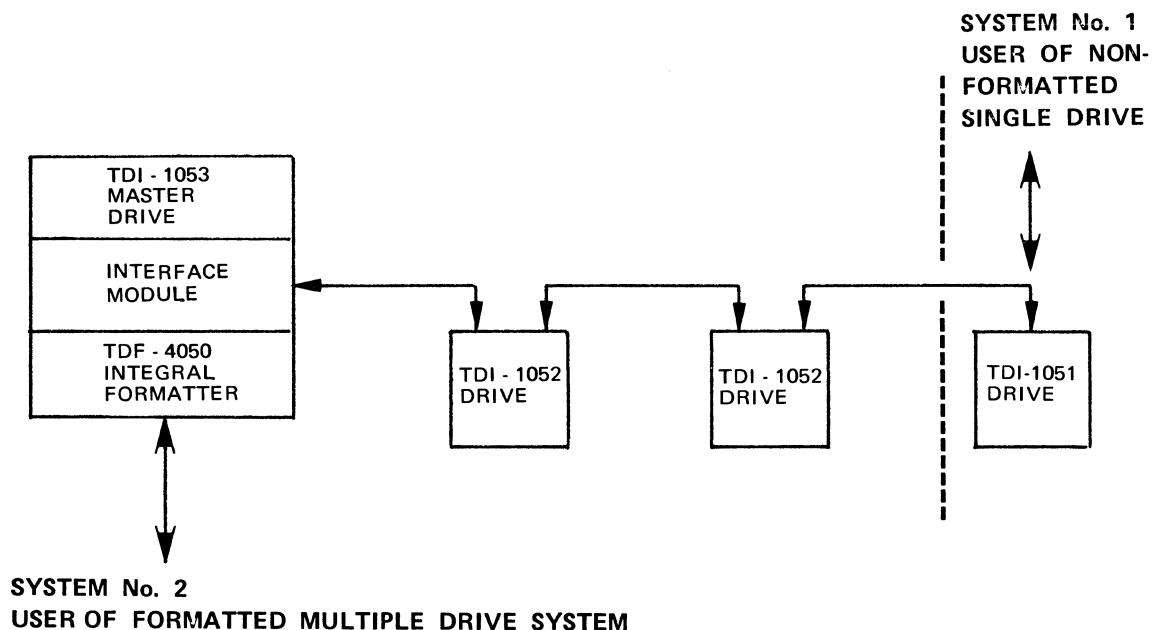


Figure 1-2. MASTER/SLAVE CONFIGURATION



When used in conjunction with the TDF 4050 integral formatter or with a compatible external tape formatter, the TDI 1050, 1051, 1052, 1053 or 1054 is capable of either writing or reading a 9-track IBM-or-industry compatible tape in the NRZI or phase encoded (PE) formats; the 7-track NRZI format can also be accommodated. The TDI 1050 series offers complete compatibility with ISO, ANSI, ECMA or IBM formats. Single tape speeds between 12.5 and 45 ips are provided. The formatter can handle intermixed drives of the same speed or at half speed as shown in Table 1.1.

TABLE 1.1. TAPE SPEEDS

| STANDARD<br>SPEED | MEASUREMENT | HALF<br>SPEED |
|-------------------|-------------|---------------|
| 45                | ips         | 22.5          |
| 37.5              | ips         | 18.75         |
| 25                | ips         | 12.5          |

The system can read and write both NRZI and PE at both standard and half speeds.

## 1.2 PHYSICAL DESCRIPTION (See Figure 1-1.)

TDI 1050 Series Tape Transports are self-contained units designed to hinge mount in a standard 19-inch RETMA rack. Figure 1-1 shows the physical configuration of the tape transport. The design provides shallow box mounting with the standard hinge assemblies. Other mounting requirements can be accommodated. An attractive vacuum-formed plastic facade covers the entire top plate. The facade incorporates a dust door with a see-through tinted panel and eight operational controls with indicators. These controls provide the necessary switching and starter indication functions for the system. For detailed information refer to Section III Operation.

### 1.2.1 Top Plate (See Figure 1-3.)

The top assembly is the main support for the other assemblies and sub-

assemblies. The top plate is a rugged, thick (13 mm), stress relieved cast aluminum structure providing an extremely stable platform for the tape path and supports all components.

To the back surface are attached the capstan and reel motors, the compliance arm assemblies, the power transformer, power supply, a rectifier bridge and the main electronic assembly.

To the front surface of the top plate attach all the critical tape components, the head, End of Tape/Beginning of Tape sensors (EOT/BOT) and tape cleaner assemblies, the facade and the switch assembly.

### 1.2.2 Capstan Motor

The capstan motor is a basket wound motor-tachometer combination with silver-graphite brushes for exceptionally long life. The low-inertia rotor motor uses little power. The steel shaft is supported by dual precision ball bearing sleeves. Run out, end play and shaft dimensions are all tightly held tolerances.

The capstan motor is mounted to a precision plate which is three-point mounted against the back of the top plate. This arrangement permits precise adjustment of the capstan perpendicularity to the tape path, eliminating tolerance build-up

### 1.2.3 Reel Motors

The reel motors are conventional, permanent magnet DC motors with permanent internal brushes. The TDI 1050 45 ips top speed limit and dynamic servo offset enables the use of a small-frame motor with inherent power savings.

As part of the supply-reel subassembly, a 360° reflecting surface is provided for WRITE RING detection. This 360° surface is sensed optically to detect the presence of the Write-Enable Ring when it is installed on the tape reel.

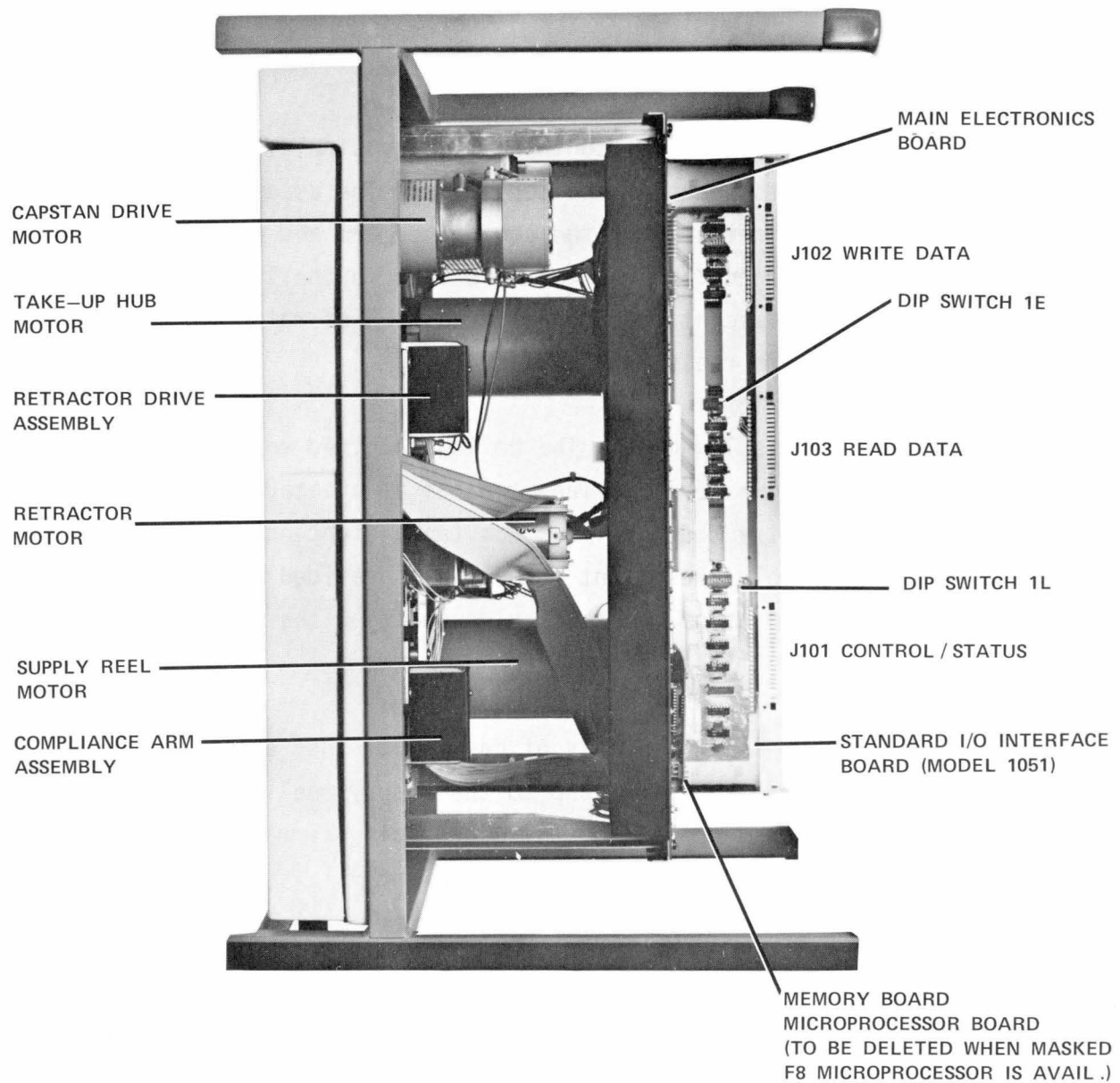


FIGURE 1-3. TAPE TRANSPORT DRIVE MOTORS & ELECTRONICS

## 1.2.4 Retractor Motor

The retractor motor is a DC motor used at low duty cycle which operates through a gear train to drive the compliance arms to the load position. This feature simplifies tape threading.

## 1.2.5 Compliance Arm Assembly (See Figure 1-4.)

The compliance arm assembly is contained in a cast aluminum housing, mounted to the flat back surface of the top plate. The assembly contains a ball-bearing-supported shaft holding the compliance arm and on which is mounted the arm position optical encoder. An aperture directs the light, from a 100,000 hour rated incandescent bulb (operated at 60% of rated voltage, to a pair of differential photo resistive cells.

The compliance arm is low-mass. The hollow-machined square arm providing excellent rigidity and low inertia. Tape tension is created by a linear spring operating within a geometry that provides constant, eight-ounce tape tension over the entire arm travel. Resilient bumpers are provided at the extremes of arm travel to prevent impact of the tape guide shaft on the top plate.

## 1.2.6 Supply Reel Hub

The supply reel hub is an assembly of cast parts that applies pressure radially outward through a resilient pad to the supply reel. The hub locking device is designed for easy operation, while providing firm holding. Reels can be mounted and dismounted quickly and conveniently.

## 1.2.7 Take Up Reel

The take up reel consists of a hub with a single flange, securely clamped to the take up reel motor. The absence of the outside flange allows easy tape threading onto the take up reel. As the tape is wound with constant tension onto the take up reel, a rigid disc results which prevents the tape from being dislodged.

## 1.2.8 Roller Guides

There are two rollers which guide the magnetic tape over the supply and

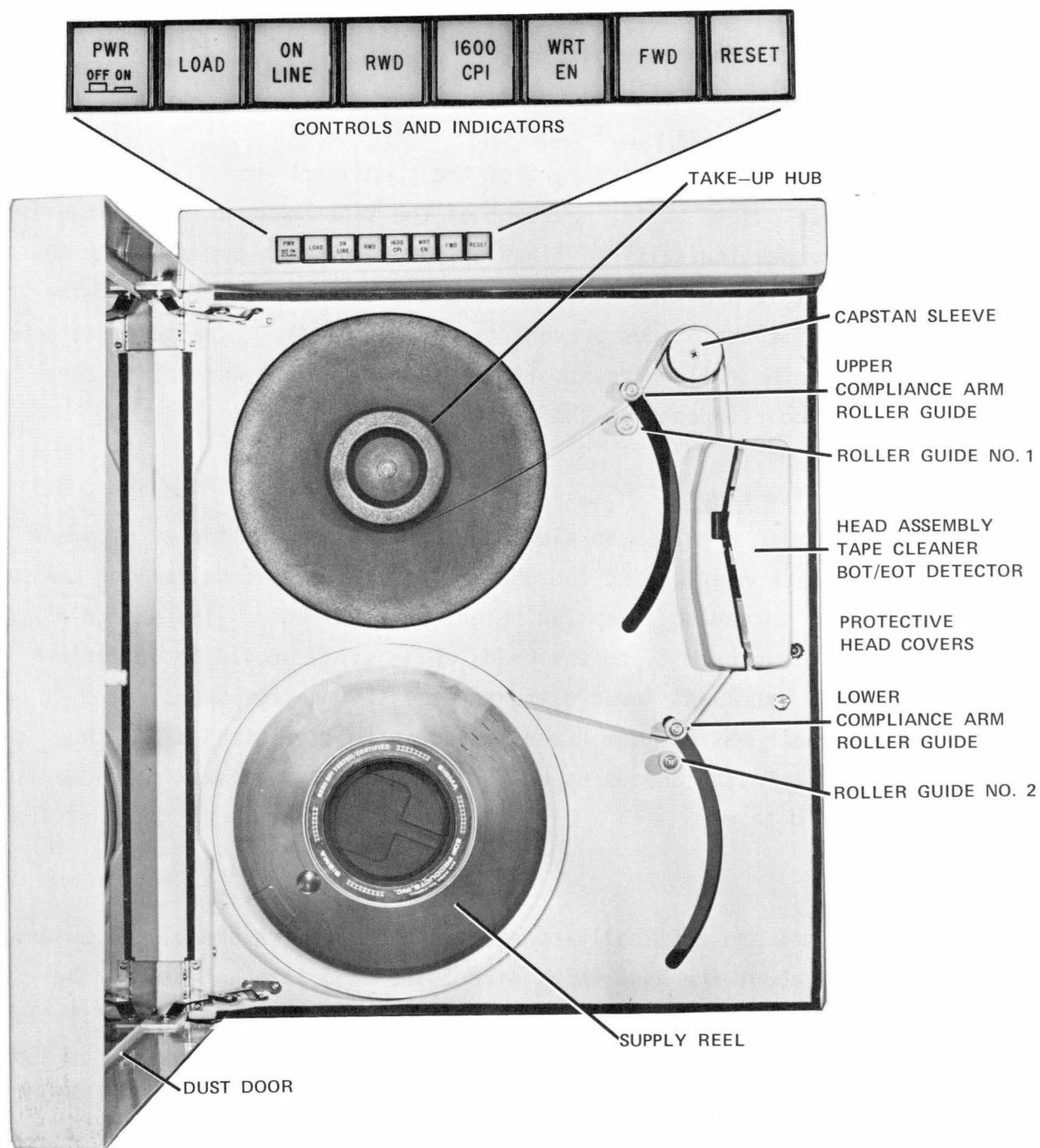


FIGURE 1-4. TAPE TRANSPORT FRONT PANEL COMPONENTS

take up reels. These guides are made of Delran (T.M.)\* and mount to precision ground reference surfaces. The guides are adjusted during alignment to compensate for tape path component tolerances.

## 1.2.9 Crowned Roller Guides

The crowned roller guides are part of the compliance arms. Based upon arm position, these guides buffer movement of the tape between the capstan and the reels. Perpendicularity is fixed by the compliance arm assembly and a height adjustment is provided to compensate for tolerance build-ups. The crowned surfaces of these guides prevent tape-edge damage. Tape tracking more readily centers on the roller crown. If the roller surface were flat, the tape would shift and ride against the flange of the guide.

## 1.2.10 Capstan Drive Wheel

The capstan drive wheel is an aluminum wheel with a coating of neoprene rubber. A collar, mounted behind the wheel, prevents tape from falling behind the capstan during threading. Capstan height is adjustable. The design places the capstan in close proximity to the head, while still providing sufficient spacing to produce excellent forward and reverse skew performance. As a result, the tape path has optimum dimensioning in this critical area, thus providing excellent instantaneous speed variations (ISV) and skew characteristics for new or old tapes.

## 1.2.11 Head Guides

The head guides are critically-spaced, single-edge, chrome-plated guides precisely located about the head which direct the tape into and out of the head area. These guides are equipped with a "floating flange", i.e., lightly spring-loaded in order to keep the reference edge of the tape against the tape reference plane of the transport. Each tape has a "signature" as a result of its slitting by the slitting machine, which results in varying tape width (within the standard tolerance). The floating flange is designed to compensate

\*Delran is a registered Trade Mark.

for this variation and to assure that the reference edge of the tape is always in contact with the fixed edge of the guide. It is to the fixed edge of these guides (the reference plane) that the vertical position of all other tape guides is adjusted.

#### 1.2.12 Head Assembly (See Figure 1-5.)

The head assembly, shielded by protective dust covers, consists of the read, write and erase heads. Also located in this area are dual-edge ceramic tape cleaners, the reference plane tape guides, and the photoelectric end and beginning of tape (EOT/BOT) detectors.

The head, a compatible 9-track NRZI/Phase Encoded unit, has both a write gap and a read gap to permit read-after-write verification. A full-width erase head is also provided to erase the tape by dc saturation in the reference direction before passing over the write head.

The dual-blade ceramic tape cleaner contacts the oxide side of the tape, removing any deposited debris which would cause head-to-tape separation and result in data dropouts.

EOT/BOT detection is accomplished optically. Photo transistors detect light reflected from the EOT or BOT markers. A reflective surface (normally blocked by the tape) is sensed by both the EOT and BOT phototransistors, indicating no tape present.

#### 1.2.13 Electronics

With the exception of the power supply assembly and associated parts, the EOT/BOT and Write Enable PC boards, the entire electronics package of the TDI 1050 series is contained on one main electronics board. The main electronics assembly include: write electronics, read electronics, control logic, servo systems for the take-up, supply, capstan and arm retractor motors and voltage regulators for the various electronic power supply requirements. The board is labeled to show the functional organization of the circuitry. Hinge

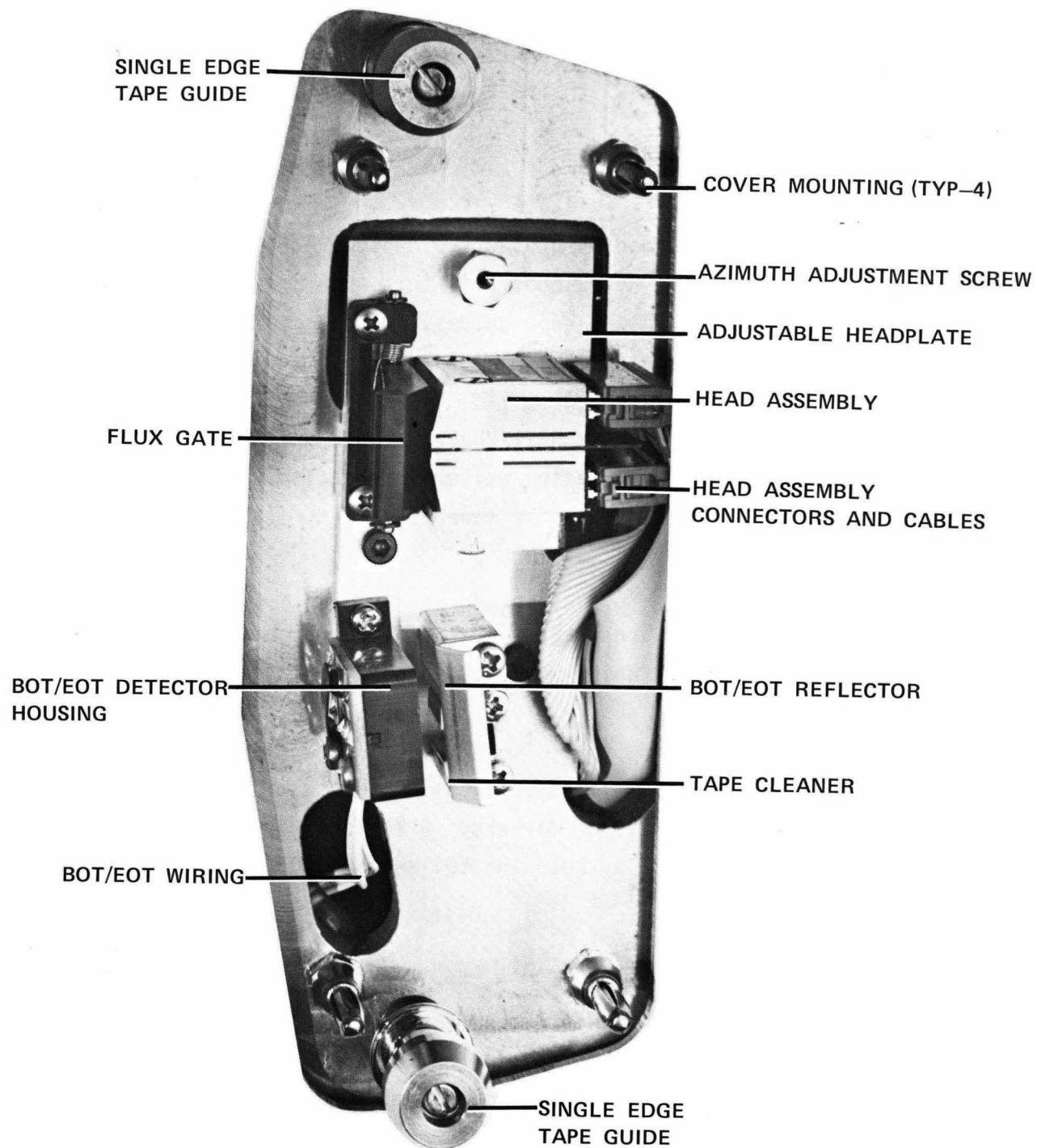


FIGURE 1-5. HEADPLATE ASSEMBLY DETAILS



mounting provides complete access to components after the two retaining screws are removed. I/O optional interfaces are attached directly to the main electronics board.

#### 1.2.14 TDF 4050 Formatter (Optional)

The TDF 4050 Tape Formatter is an electronic unit designed to be mounted within the TDI 1050. It is included in Models TDI 1053 and 1054. This formatter provides generation and reading of ANSI, IBM, AND ECMA - compatible tapes. The dual-mode formatter is designed to work with 9-track 1600 bpi PE and 800 bpi NRZI tape drives and 7-track 200/556/800 bpi NRZI tape drives.

In all cases the formatter performs the basic functions of formatting data written on tape and decoding data read from tape. Error checking is performed on data read from tape. The TDF 4050 Tape Formatter can control from one to four tape transports. The transports must be of same or half speed, but can be a mix of different formats, 9 or 7 track and PE or NRZI.

Interfacing and operation of TDF 4050 Tape Formatter is compatible with industry standard. However, it is possible to reprogram the formatter to suit customer requirements. The formatter is contained on one PC board 18 inches by 10 inches.

All timing during start and stop and during read and write operation are controlled by one master crystal oscillator. There are no monostables and no R-C timing networks.

#### 1.2.15 Power Supply and Voltage Regulators

The power supply consists of the filter subassembly, power transformer and rectifier. Each element is individually mounted to the rear of the top plate. The main line circuit is fused and an input power line filter is provided for noise reduction. Unregulated  $\pm 20$  vdc power is generated by the supply for unregulated requirements and for application to the voltage regulators. Individual fuses, mounted on the main electronics board, are provided for the 20 volt lines.

The voltage regulators and motor-drive power transistors are mounted on a heat sink assembly on the main electronics board. The regulators produce  $\pm 15\text{vdc}$  and  $+5\text{vdc}$  power outputs.

In the case of a TDI 1050 with TDF 4050 formatter (Model 1053 or 1054), a different power assembly is supplied in order to provide the higher  $+5\text{vdc}$  current requirements for formatter logic.

The input power filter assembly enables easy change of the input voltages (100, 120, 220 and 240vdc). All components are designed to meet U.L. and C.S.A. standards. The TDI 1050 system meets standards set for component recognition under UL478, and for certification under C.S.A. C22.2 No. 154.

### 1.3 FUNCTIONAL DESCRIPTION OF BASIC TDI 1050 DRIVE

This section provides a functional description of the TDI 1050, 1051, and 1052 drives. For models including the TDF 4050 formatter, (TDI 1053 and 1054) refer to Appendix C for additional information.

#### 1.3.1 Write Electronics

The write electronics network receives NRZ or PE data from the formatter and converts the signals to write current levels for application to the write head. A write deskew feature provides variable delays in each channel to compensate for write head mechanical tolerances. Write deskew is performed for both NRZI and PE modes.

#### 1.3.2 Read Electronics

The read electronics receives analog signals from the read head via a shielded flat cable. The read signals are then amplified, detected and converted to NRZ or PE digital wave trains for transfer to the tape formatter. Read Deskew is performed in the NRZI mode.

#### 1.3.3 Control Logic

A single F8 microprocessor chip serves as the primary control element in the TDI 1050. The program is stored in 2K of on-chip ROM.

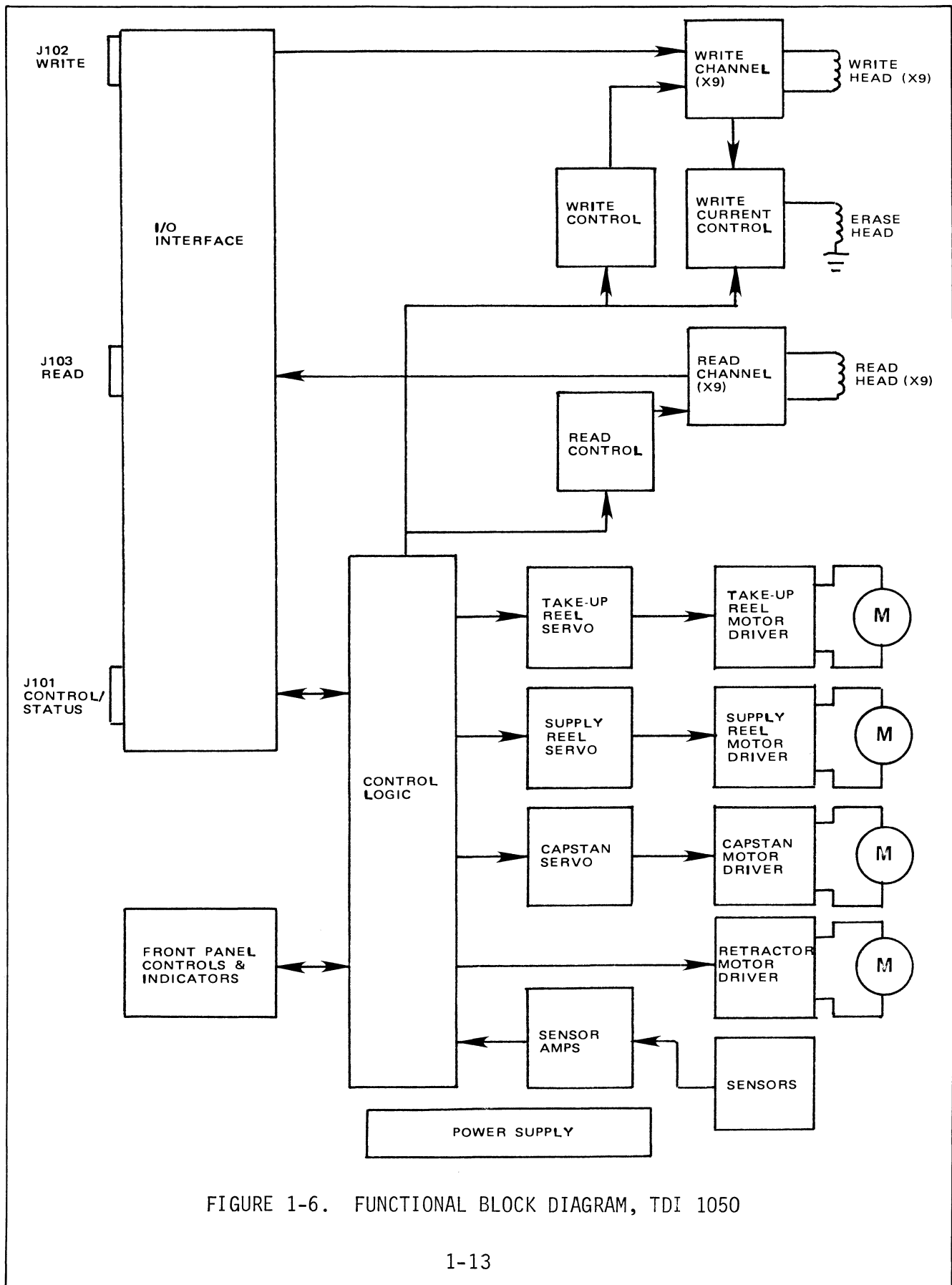


FIGURE 1-6. FUNCTIONAL BLOCK DIAGRAM, TDI 1050

An added feature of the microprocessor is built-in-diagnostics which allows set-up and exercising of the TDI 1050. (See Section VII, Testing, for complete description.) It should be noted, that this microprocessor control provides superior reliability and reduces mean time to repair (MTTR) to unplug and plug the microprocessor.

#### 1.3.4 Power-Fail

A power fail relay is mounted to the main board assembly. When power fails, the relay disconnects the motors from the servo amplifier and short circuits the motor terminals, giving a dynamic braking effect. The relay is not switched during normal operation.

#### 1.3.5 I/O Connectors

The I/O connectors on the main electronic board, J111 (Control), J112 (Write) and J113 (Read) interface to TTL logic level signals, converted to industry compatible or special interfaces by the I/O board assembly.

### 1.4 DATA FORMATTING

For information on data formatting refer to Appendix C. The data formatting of the TDI 1050 System conforms to industry standards. Figures 1-7 and 1-8 illustrate basic format followed for PE and NRZI methods respectively. Figure 1-9 illustrates the organization of blocks on the tape and the track spacing for 9-track PE and NRZI and 7-track NRZI.

### 1.5 OPTIONS

Options for the TDI 1050 Series fall into two categories:

- a. Configuration at time of order.
- b. Jumper Selectable.

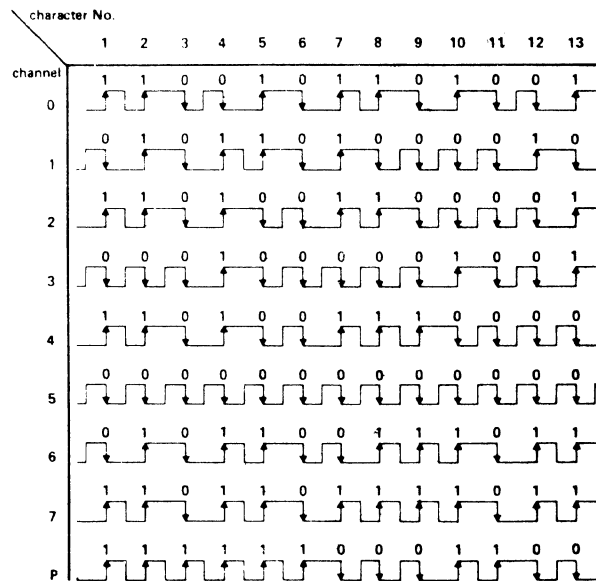
#### 1.5.1 Options Available at Time of Order

Basic Models:

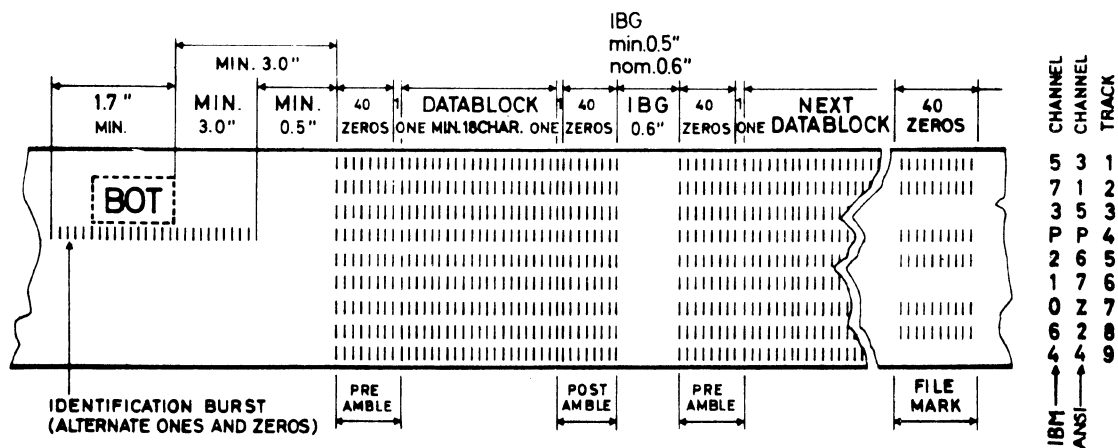
TDI 1050  
TDI 1051

TDI 1052  
TDI 1053

TDI 1054

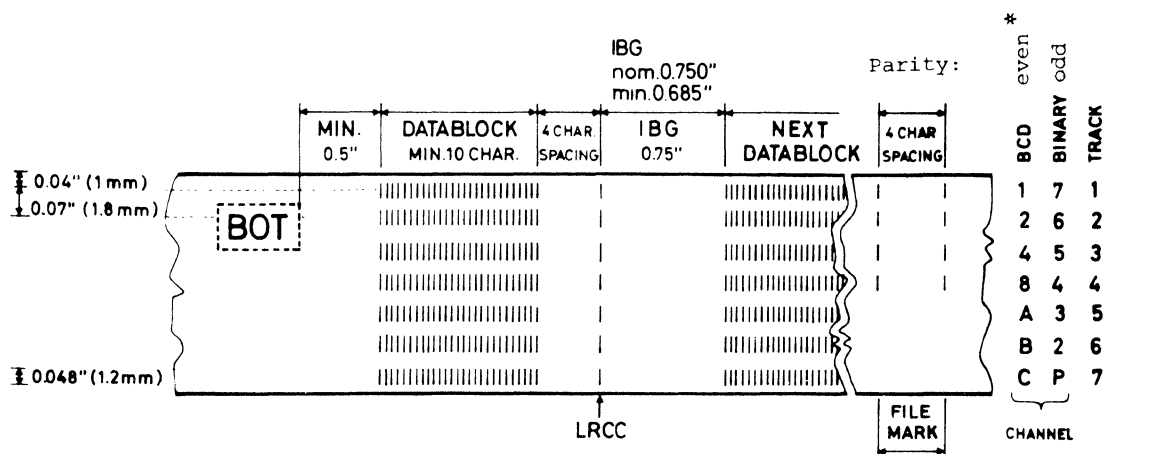


PE, Basic Principle



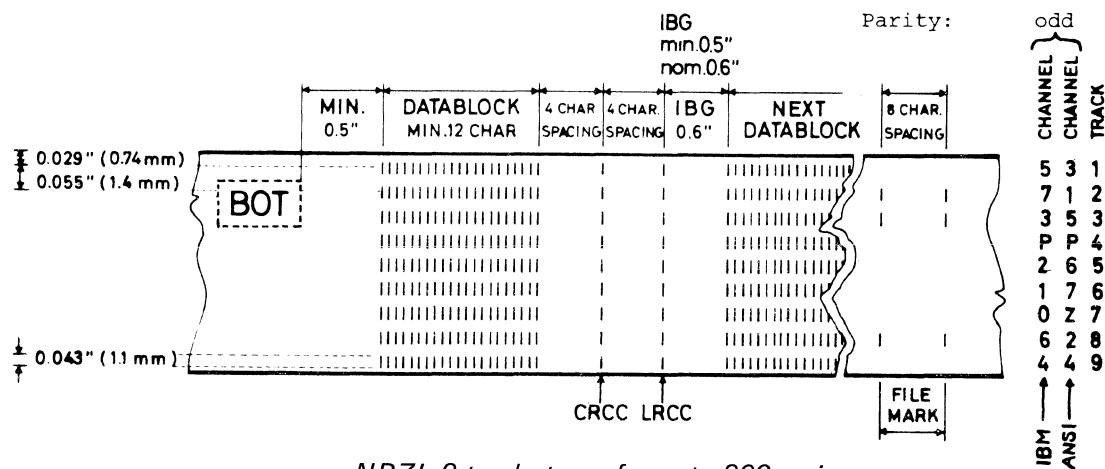
PE 9-track format. 1600 cpi

FIGURE 1-7. PHASE ENCODED TAPE FORMAT



\*no all "0" character allowed

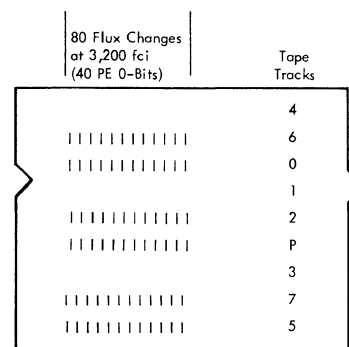
NRZI 7-track tape format. 200/556/800 cpi.



NRZI 9-track tape format. 800 cpi.

FIGURE 1-8. NRZI TAPE FORMAT

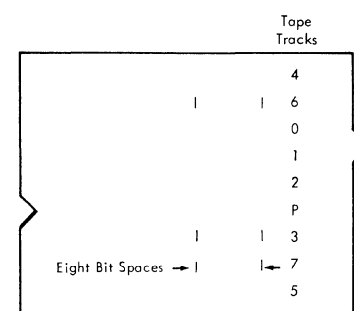
## NINE-TRACK PE TAPE MARK



A PE tape mark is a special control block that consists of at least 80 flux reversals at 3,200 fci in data tracks P, 0, 2, 5, 6, and 7. Tracks 1, 3, and 4 are dc-erased. For recognition, the tape mark must contain at least 64 flux reversals in data tracks P, 0, and 5 (zone 1) or tracks 2, 6, and 7 (zone 2), with tracks 1, 3, and 4 (zone 3) dc-erased. Although the tape mark is preceded by approximately 3.75\* inches of erased tape, this gap is not a requirement.

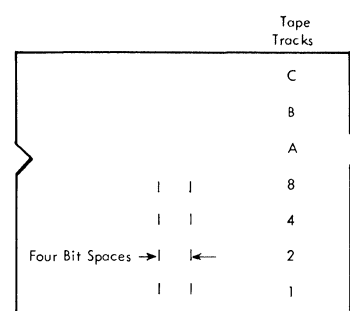
\* Varies with tape unit speed and mechanical adjustment.

## NINE-TRACK NRZI TAPE MARK



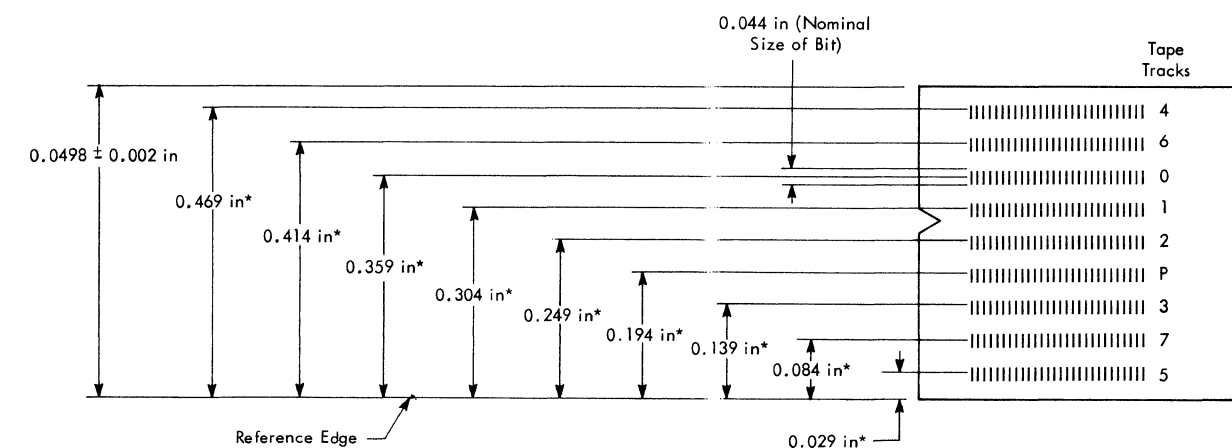
A nine-track NRZI tape mark is a special control block that consists of a character with 1-bits in data tracks 3, 6, and 7, and an identical LRC character eight bit spaces from it. No CRC character is written. Although the tape mark is preceded by approximately 3.75\* inches of erased tape, this gap is not a requirement.

## SEVEN-TRACK NRZI TAPE MARK



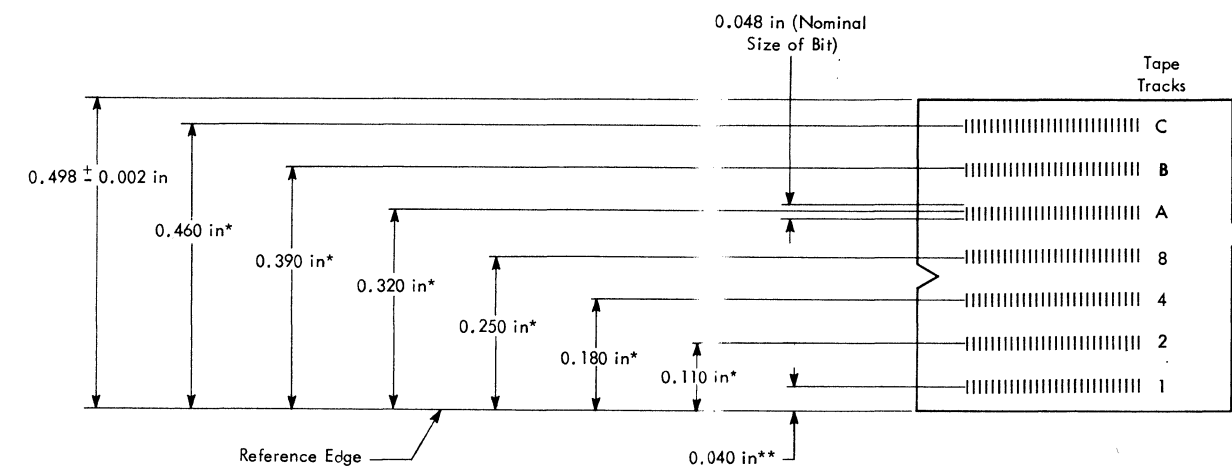
A seven-track NRZI tape mark is a special control block that consists of a character with 1-bits in data tracks 8, 4, 2, and 1, and an identical LRC character four bit spaces from it. Although the tape mark is preceded by approximately 3.90\* inches of erased tape, this gap is not a requirement.

## NINE-TRACK TAPE



\*All track locations  $\pm 0.003$  in.

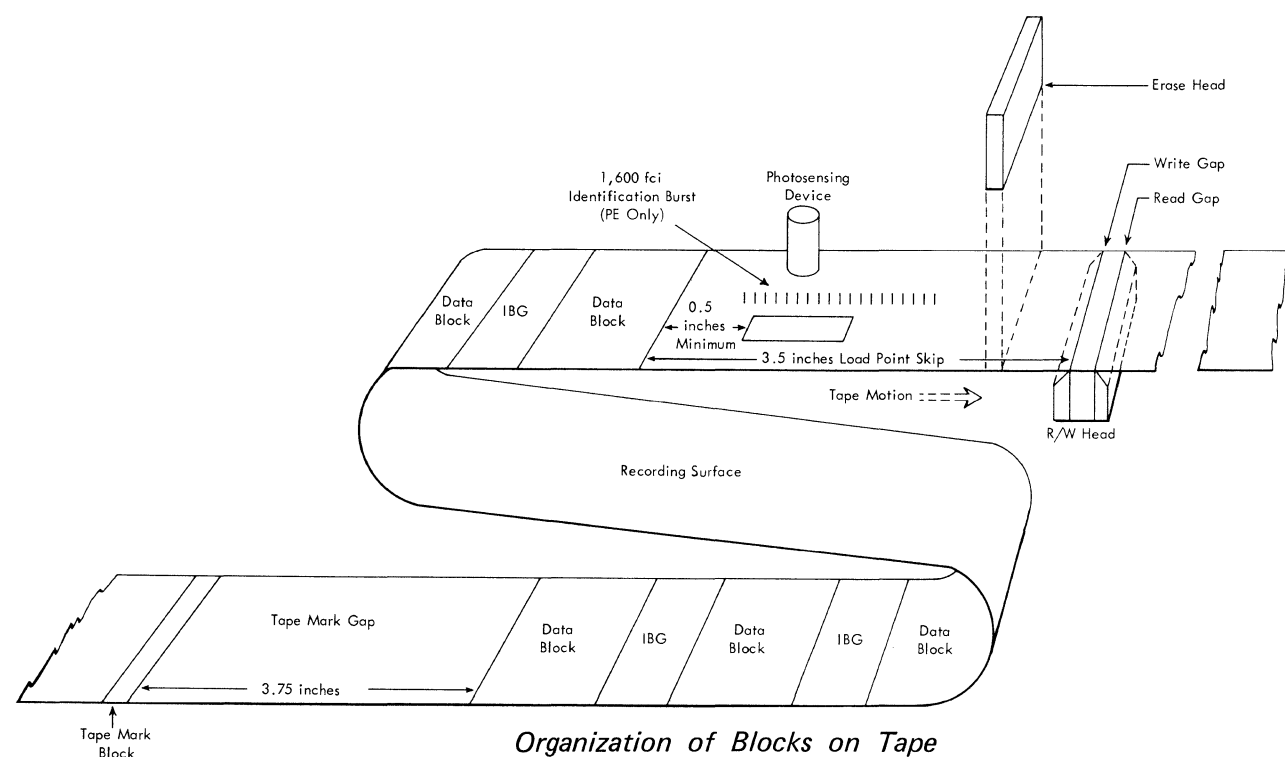
## SEVEN-TRACK TAPE



\*Track locations 2-C:  $+0.0040$  in.  
 $-0.0035$  in.

\*\*Track location 1:  $\pm 0.0025$  in.

## Track Spacing for Seven-and Nine-Track Tape



Organization of Blocks on Tape

FIGURE 1-9. TAPE ORGANIZATION

Basic Configurations:

9-Track READ-AFTER-WRITE (PE/NRZI)

7-Track READ-AFTER-WRITE (200/556, 556/800, 200/800 BPI)

Basic Speeds:

|          |                                            |
|----------|--------------------------------------------|
| 12.5 ips | This low speed requires component changes. |
|----------|--------------------------------------------|

|         |  |
|---------|--|
| 25. ips |  |
|---------|--|

|           |  |
|-----------|--|
| 18.75 ips |  |
|-----------|--|

|          |  |
|----------|--|
| 37.5 ips |  |
|----------|--|

|         |  |
|---------|--|
| 45. ips |  |
|---------|--|

These speeds are settable by electrical adjustments only.

Cables:

Multiple Transport Cables

One set is required for each additional drive.

Interface:

Twisted Pair

"3M Type" flat cable

1.5.2 Options Available Through Switch Settings or Jumper Placement

See Tables 2.4 and 2.5.





# TANDBERG

## SECTION II INSTALLATION AND HANDLING

PUBLICATION NO. 00-10001

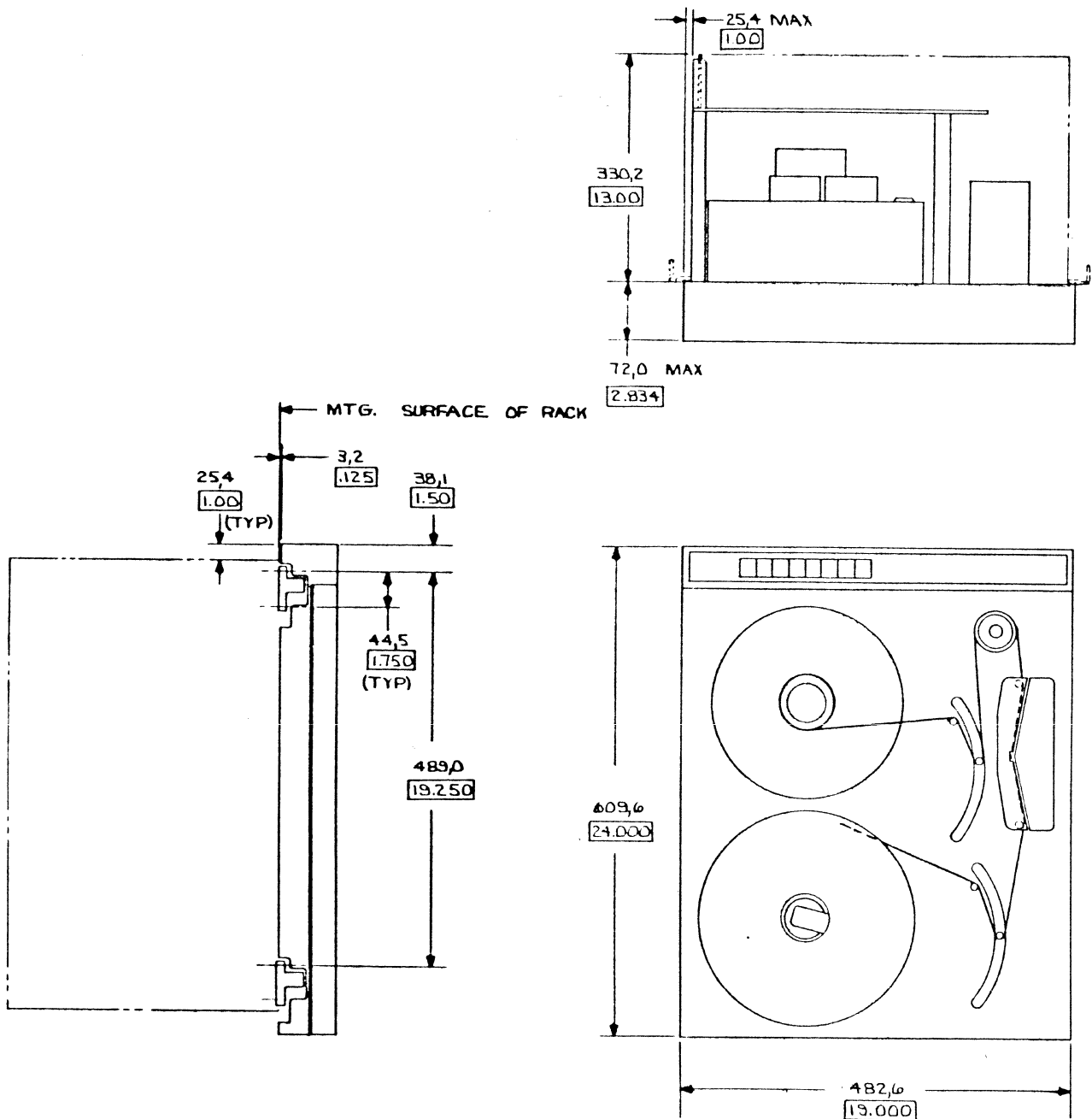


FIGURE 2-1. DIMENSIONAL OUTLINE

## SECTION II

### INSTALLATION AND HANDLING

#### 2.1 INTRODUCTION

This section contains installation information relating to the TDI 1050 Series Tape Transports. Included in this section are the physical description, space requirements, unpacking, assembly and installation procedures, required installation tools and equipment, interface requirements and unit repacking procedures.

#### 2.2 PHYSICAL DESCRIPTION

The TDI 1050 Tape Transport is contained in a single unit. Overall dimensions are illustrated in Figure 2-1. An I/O connector assembly is located at the rear of the unit to provide connections with the system. The control panel is mounted on the front of the unit. (See Figure 2-2.)

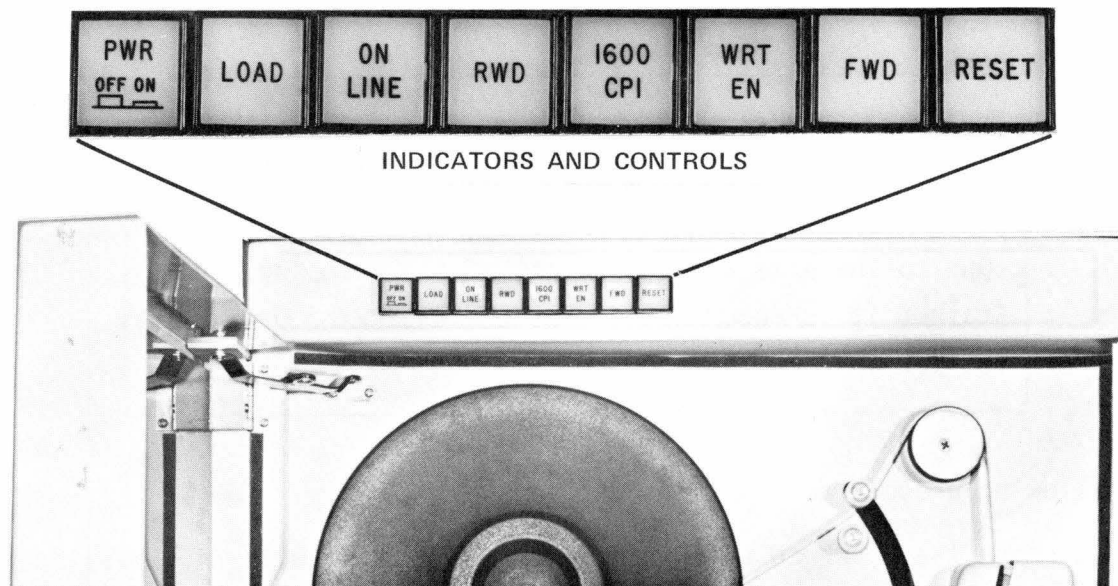


FIGURE 2-2. CONTROL PANEL

## 2.3 ACCEPTANCE OF DELIVERY

Prior to accepting delivery, a careful inspection of the shipping container must be made. Tandberg Data, Inc. ships all tape transports in double box containers. A severe gouge, abrasion or scratch, a badly battered corner or edge, constitutes evidence of mishandling that may have damaged the unit. If there is any damage to the shipping container, a note of such must be signed by the carrier's representative acknowledging the damage before delivery can be accepted.

## 2.4 UNPACKING INSTRUCTIONS

Each TDI Tape Transport System is shipped in a container 25 inches wide, by 25 inches deep, by 32.5 inches high. The shipping container is of double box construction with foam corner blocks between the inner and outer cartons.

### **NOTE**

In preparing to unpack the tape transport, provisions should be made to retain the shipping containers and packing materials if it should become necessary to repack the unit for shipment to another installation site or to return it to manufacturer for repair.

### **NOTE**

Due to the size and the weight of the shipping container it is recommended that the unpacking procedure be performed by two men.

The following procedure is recommended for unpacking:

1. Move the packaged unit into the room where it will be installed or tested.

2. Select an area of sufficient size to allow two men to freely handle the containers.
3. Open the outer carton and fold back the flaps. Remove the four foam blocks. (Save.)
4. Turn carton over on top which is now open. (See Figure 2-3.)
5. Lift outer carton from inner carton. (Save.)
6. Remove remaining four foam corner blocks. (Save.)
7. Open inner box and fold back the flaps as shown in Figure 2-4.

### CAUTION

Observe Caution notice on inner box.

8. Turn carton over on top which is now open (See Figure 2-5.) and remove carton. (Save carton for reshipment.)
9. Tape transport is now sitting in the shipping frame, ready for receiving inspections.

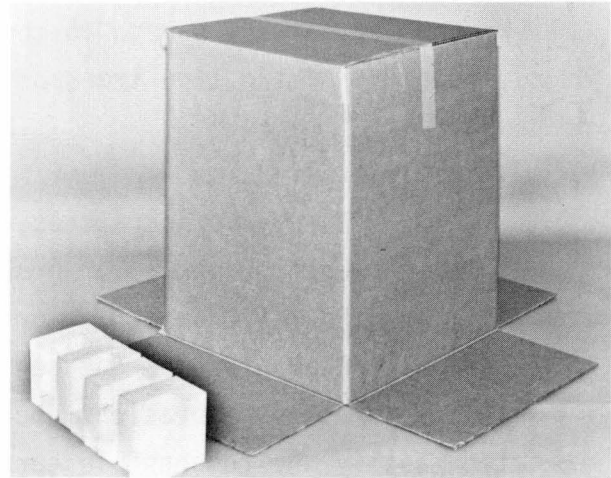


FIGURE 2-3

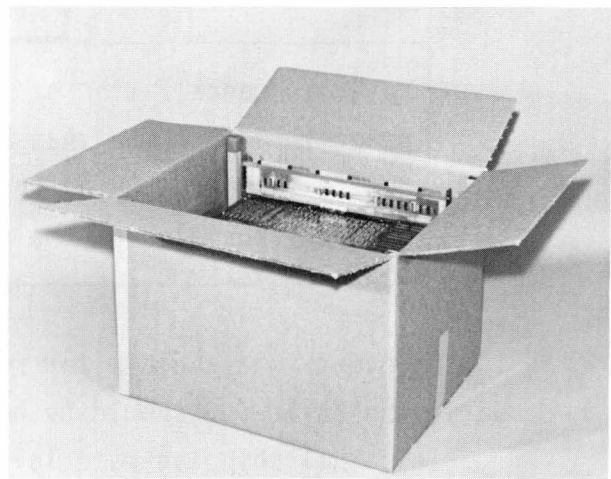


FIGURE 2-4

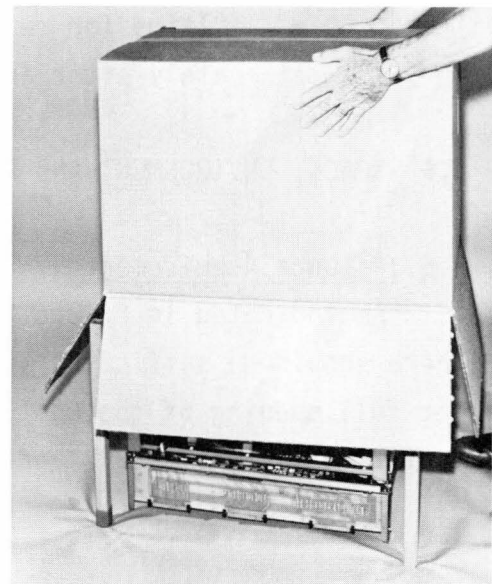


FIGURE 2-5

## 2.5 RECEIVING INSPECTION

Whether or not any damage to the shipping container was noted, a thorough inspection of the tape transport is essential prior to the application of power.

Visually examine:

- Facade for scratches, cracks or abrasions.
- Control panel for broken indicators or damaged switches
- Rear I/O assembly for damaged connectors.
- Rear side for damaged components.

If any scratches, abrasions, dents, cracks or other evidence of damage is noted, notify the responsible carrier and Tandberg Data, Inc. immediately.

### **NOTE**

To avoid cancellation of the Warranty, DO NOT apply power to a unit that has been dropped or damaged. Notify Tandberg, Data, Inc. requesting information as to disposition of the damaged unit.

In the event that a claim for reimbursement of damaged cost becomes necessary, the following should be noted:

- All shipping materials should be retained for evidence of damage.
- Claims for reimbursement must be filed with the carrier immediately after arrival of shipment.

## 2.6 SPACE, ENVIRONMENT AND POWER REQUIREMENTS

### 2.6.1 Space Requirements

As indicated in Figure 2-1, allowance should be made for working access. There should be sufficient space to the left and front of the unit to allow for full opening of the unit on the mounting hinges. The unit is designed to fit vertically in a standard 19-inch equipment rack. The unit may also

be mounted horizontally in a 24-inch equipment rack. Mounting holes are provided for either position in the top plate casting.

## 2.6.2 Environment

The tape transport is to be operated in an ambient temperature range of +36 degrees F to +122 degrees F (+2°C to +50°C). It is recommended that any heat dissipating devices be mounted above the unit to avoid exceeding their temperature limits. The device may be exposed non-operationally to temperatures between -50 degrees F and +160 degrees F (-45°C to +71°C). Humidity conditions from 15% to 95% (non-condensing) are suitable for operation of the Tape Transport System.

## 2.6.3 Power

The input power requirements for the TDI 1050 Tape Transport are selectable from 100/120/220/240  $\pm 4\%$  at a power rating of 300 watts maximum.

## 2.7 INITIAL CHECKOUT PROCEDURE

Initial procedures for power-up and system checkout are as follows. It is not necessary to mount the tape transport in the equipment rack for these tests. The following tests may be performed with the tape transport mounted in the shipping frame.

### 2.7.1 Primary Power Application

Primary line power is applied to the tape transport via the power cord included with shipment. This cord should be connected between the receptacle at the rear of the power supply and the appropriate power source, (100, 120, 220, 240 volts). If the wrong line voltage is specified on the identification label as shown in Figure 2-7, refer to Figure 2-6 and perform the following procedure:

1. Slide the protective fuse cover (located at the rear of the power supply) upwards to uncover the line power fuse.
2. Remove the fuse by pulling the FUSE PULL tab.



3. Remove the voltage selection PC board. Re-orientate the board so that the desired voltage value appears at the upper right side (See Figure 2-6). Reinstall the board in the slot.
4. Reinstall a fuse of the proper value, (See Table 2.1.) then slide the protective cover back in place.

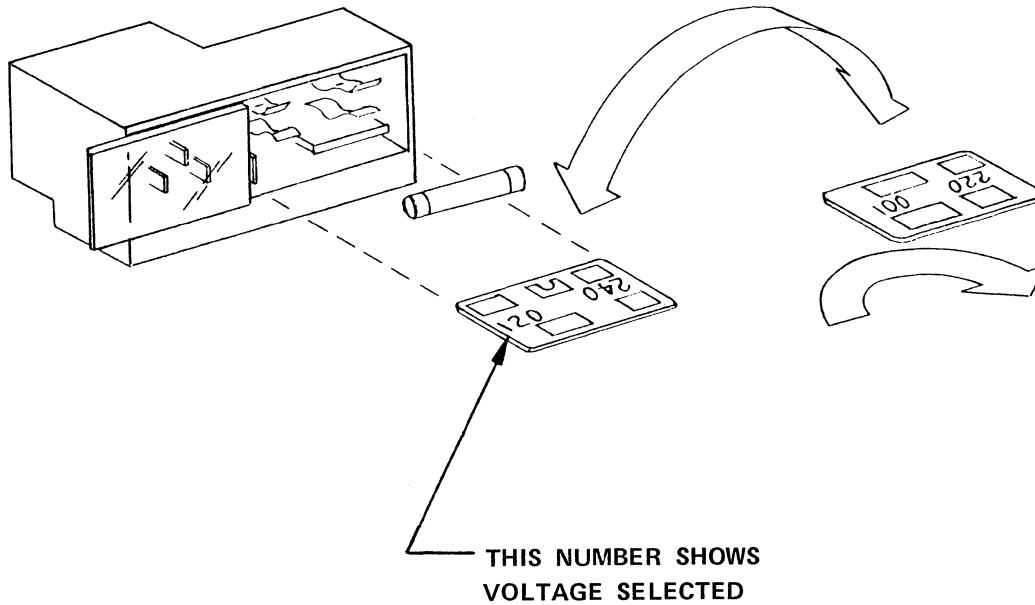
TABLE 2.1. LINE VOLTAGE/FUSE SELECTION

| LINE VOLTAGE RANGE | VOLTAGE SELECTED | FUSE REQUIRED |
|--------------------|------------------|---------------|
| 90-110             | 100 VOLTS        | 6 AMP         |
| 108-132            | 120 VOLTS        |               |
| 208-242            | 220 VOLTS        | 3 AMP         |
| 218-264            | 240 VOLTS        |               |

## 2.7.2 Initial Checkout

The functions of all controls and indicators are described in Section III, Operations. The following procedure is provided to verify that basic transport functions are operational, either before the unit is installed in the equipment rack, or before system interface cables are connected.

1. Check the identification label at the rear of the top plate (See Figure 2-8.) to verify that the primary power requirements coincides with the line voltage at the installation site. If power requirements must be altered, refer to paragraph 2.7.1.
2. Connect the power cord between the receptacle at the rear of the power supply and the appropriate line power outlet.
3. Apply primary power by depressing PWR switch.
4. Enter Operation Quick-Check by depressing WRT ENB and LOAD switches with no tape mounted.



## VOLTAGE SELECTED

1. SLIDE OPEN FUSE COVER AND PULL FUSE TAB.
2. SELECT OPERATING VOLTAGE BY ORIENTING PC BOARD TO DESIRED POSITION BY FLIPPING AND/OR ROTATING BOARD SO THAT VOLTAGE IS SHOWN ON TOP LEFT SIDE, AND PUSH BOARD BACK INTO MODULE SLOT.
3. ROTATE FUSE—PULL BACK INTO NORMAL POSITION AND REINSERT FUSE INTO HOLDER, USING CAUTION TO SELECT CORRECT FUSE VALUE. SEE TABLE 2.1 FOR CORRECT SIZE FUSE FOR THE VOLTAGE SELECTED.

FIGURE 2-6. INPUT POWER VOLTAGE SELECTION

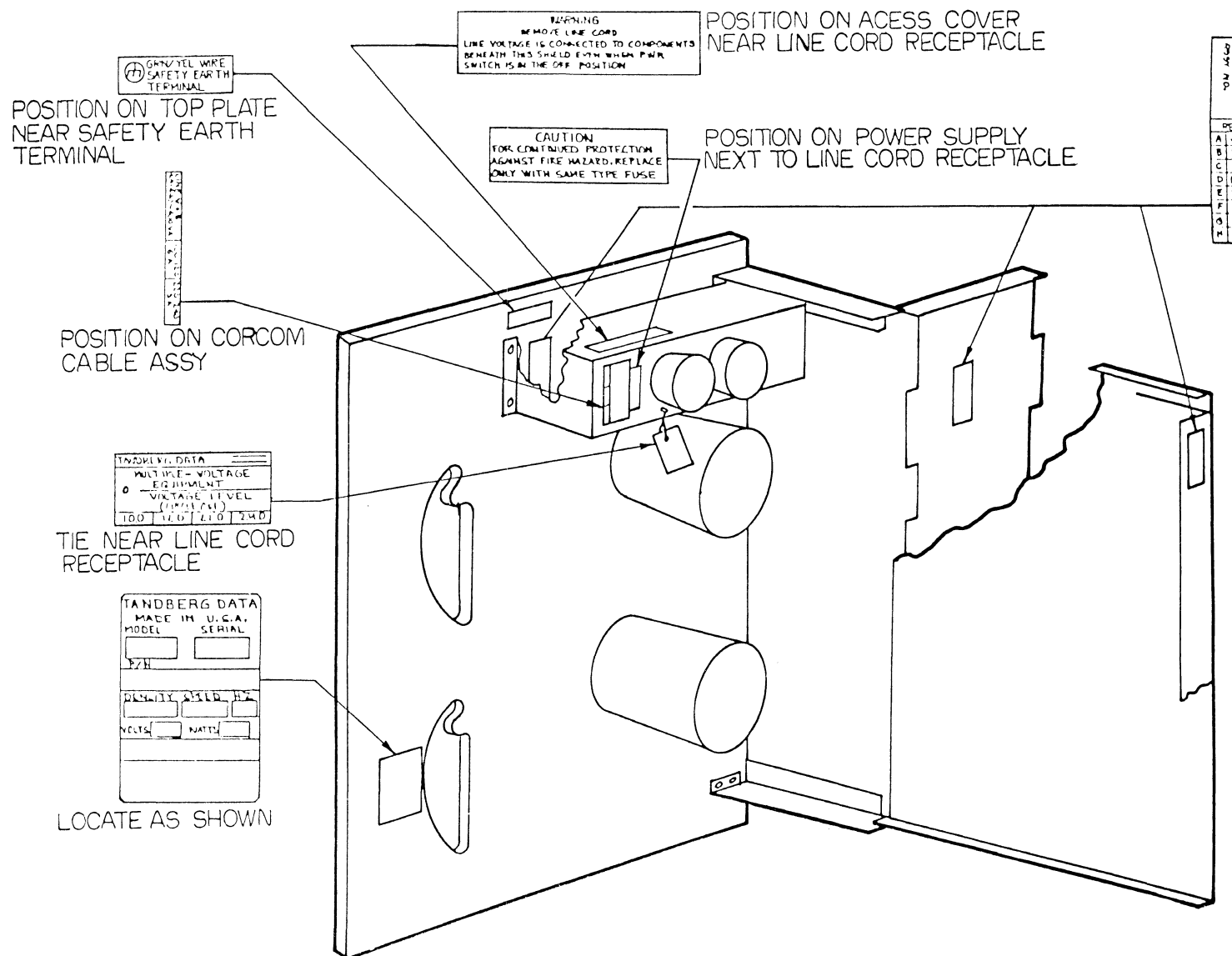


FIGURE 2-7. LABEL LOCATIONS ON TDI 1050 SERIES

**NOTE**

DO NOT install tape before or during Operation Quick-Check sequence.

5. Observe the operation of the various servos. The reels will run forward for five seconds, then reverse. During the above check, the retractors will retract and the capstan will rotate forward and reverse. The object of this check is to verify that all servos are functioning.
6. Momentarily depress RESET to exit check.
7. Install a magnetic tape on the transport as described in Section III.
8. Depress LOAD switch. Verify that the tape advances to load point and halts. The LOAD and ON LINE indicators should now be illuminated.
9. Depress the RESET switch and verify that the ON LINE lamp extinguishes.
10. Depress the FORWARD switch and verify that forward tape motion occurs. Depress the RESET switch to halt tape motion.
11. Depress the REWIND switch. Verify that the tape returns to the load point and halts. The ON LINE indicator should remain extinguished.
12. Depress the ON LINE switch and verify that that the ON LINE indicator lights.
13. Depress the REWIND switch, the tape unloads. Depress the POWER switch. The initial checkout procedure is now complete.

## 2.8 MOUNTING PROCEDURE

The tape transport is designed for installation in a standard 19-inch RETMA rack. The unit is supported by two hinge assemblies attached to the left side of the top plate assembly, and is held in place by a single pawl fastener. Mounting details are shown in Figure 2-8. The following procedure is recommended for installation:

1. Bolt support flange assemblies to RETMA rack as necessary.

**NOTE**

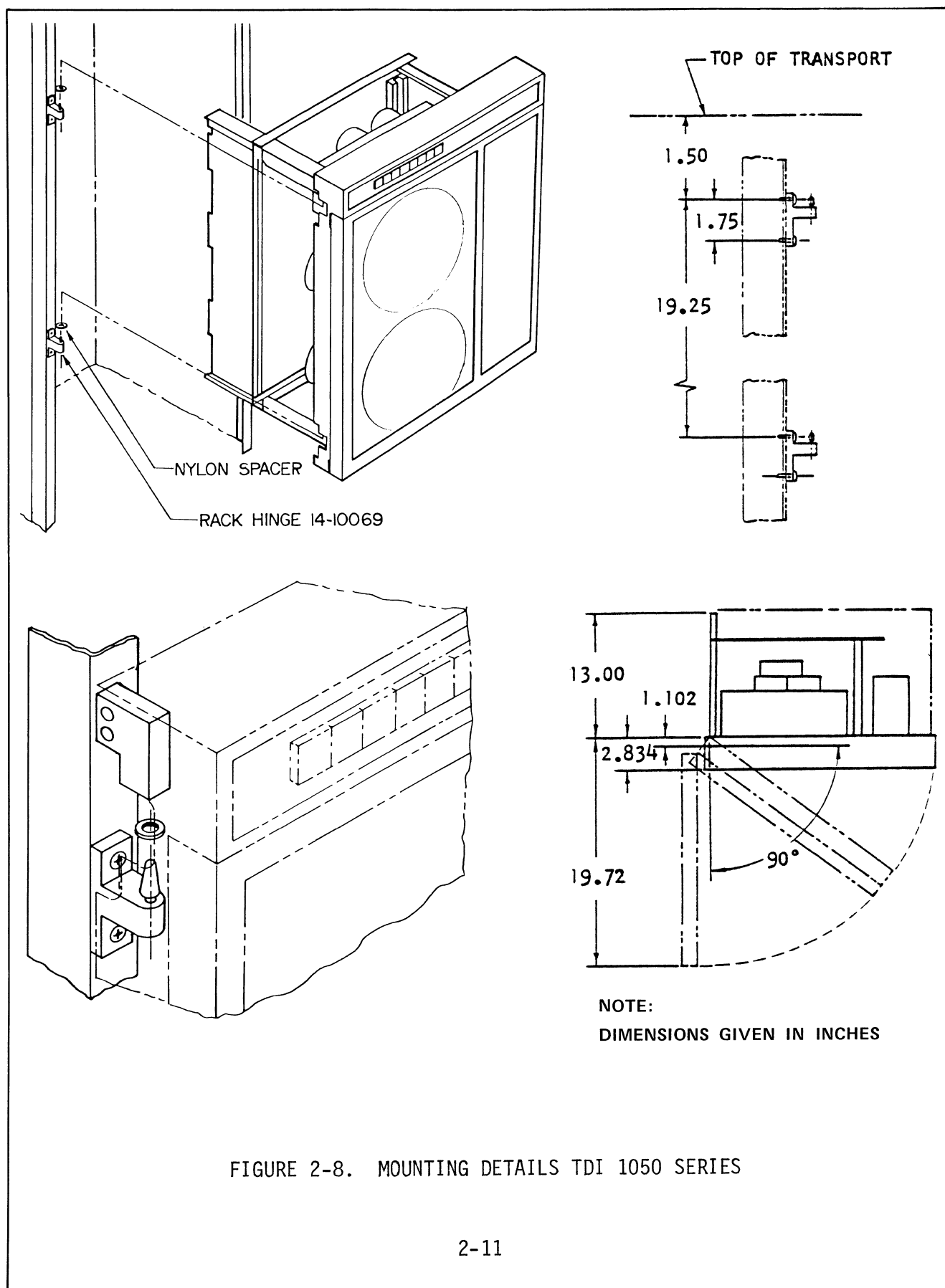
The safety block in Step 2 is not a structural support member. Its purpose is to prevent the transport from being inadvertently lifted from the mounting.

2. Remove Safety Block from transport chassis. (See Figure 2-9.)
3. Place tape transport in horizontal position (on its back). Remove four allen head screws to detach transport from shipping support frame.

**CAUTION**

Ensure that the equipment rack is secure against movement or tipping. To avoid damage, lift the transport only by the top plate. Do not support the weight of the transport by using the PC board mounting frame or other components as lift points.

4. Install nylon spacers on rack hinges. (See Figure 2-8.)
5. Hoist tape transport onto mounting hinges in RETMA rack, then replace safety block under lower hinge.
6. Latch tape transport chassis into place by rotating pawl fastener in clockwise direction.
7. Perform cleaning procedures described in Section V.
8. Perform final check of installation to verify completeness.



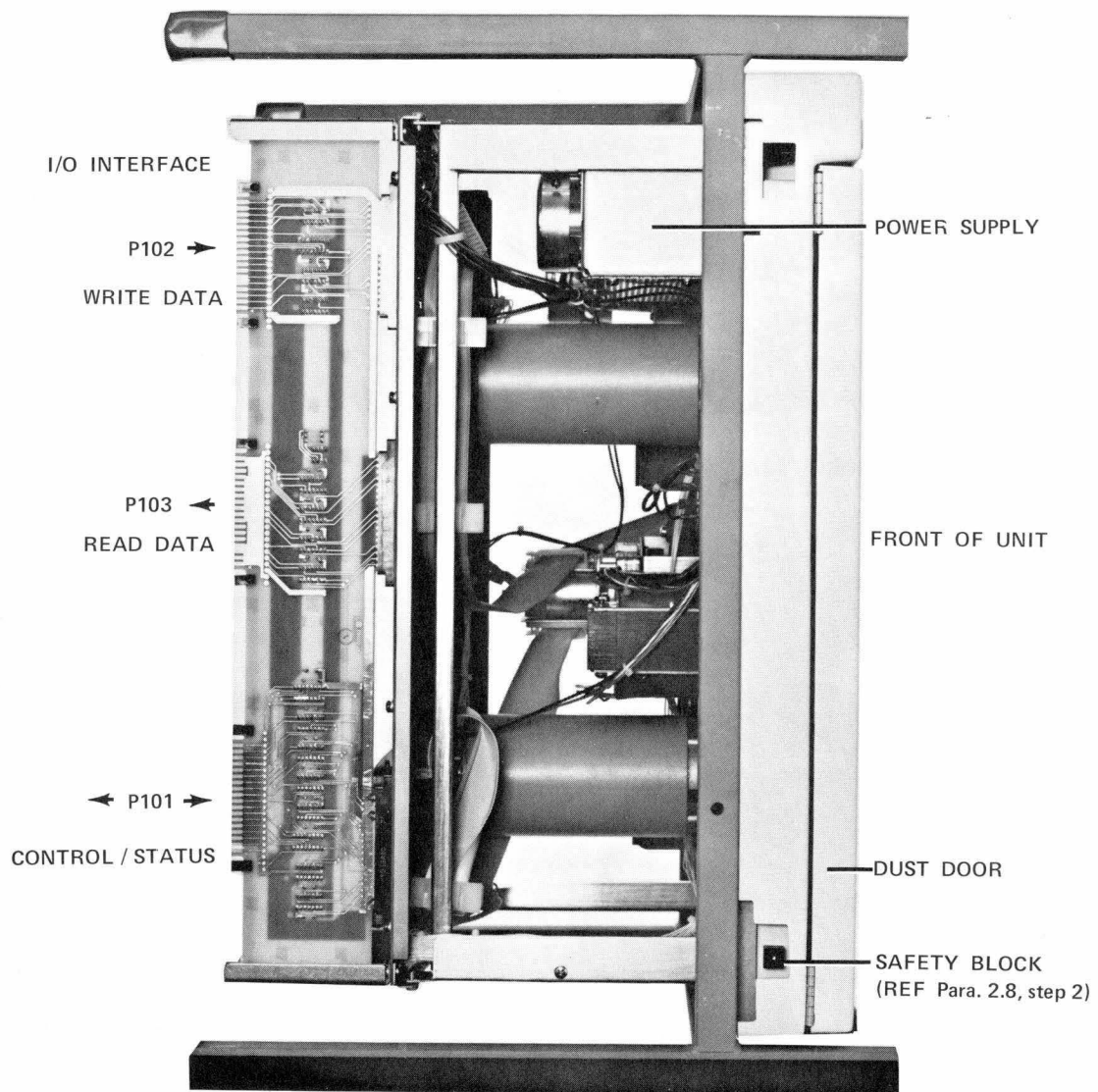


FIGURE 2-9. TRANSPORT MOUNTING SAFETY BLOCK AND INTERFACE DETAILS

## 2.9 INTERFACE

Three, 36-lead twisted pair cables are used for interconnection between the tape transport and external formatter. These cables are installed on the card-edge connectors on the I/O interface board, (See Figure 2-9.) and their pin assignments are specified in Table 2.3.

### 2.9.1 Interface Description

The TDI 1050 Series has several interface options available to the user. They vary from the minimal drive control, unformatted data, and low power T<sup>2</sup>L levels to full operational control with complete formatted data, low impedance line drivers and multiple drive interface. In all cases, the electronics associated with the interface are housed within the envelope of the TDI 1050 Series tape transport eliminating the need for additional external modules within the system. The TDI 1050 system conforms to IBM, ANSI and ECMA formats, however, the channel identification used by IBM and ANSI/ECMA is different. Table 2.2 shows the connection between the formatter input data lines (FWD0-FWD7) and the track number.

TABLE 2.2. CHANNEL IDENTIFICATION COMPARISON

| INTERFACE LINES | 9-TRACK     |                       |                |                    |
|-----------------|-------------|-----------------------|----------------|--------------------|
|                 | IBM CHANNEL | ANSI/ECMA ENVIRONMENT | ANSI TRACK NO. | ANSI ASCII CHANNEL |
| <u>FWD0</u>     | 0           | E8                    | 7              | Z                  |
| <u>FWD1</u>     | 1           | E7                    | 6              | 7                  |
| <u>FWD2</u>     | 2           | E6                    | 5              | 6                  |
| <u>FWD3</u>     | 3           | E5                    | 3              | 5                  |
| <u>FWD4</u>     | 4           | E4                    | 9              | 4                  |
| <u>FWD5</u>     | 5           | E3                    | 1              | 3                  |
| <u>FWD6</u>     | 6           | E2                    | 8              | 2                  |
| <u>FWD7</u>     | 7           | E1                    | 2              | 1                  |



Within the TDI 1050 system, two interfaces are of general user interest. They are: (1) between the user's non-formatted controller and the TDI 1053 or 1054 drive and (2) between the user's formatted controller and the TDI 1051 drive. (See Figure 1-2.)

The TDF 4050 formatter mounts directly within the master drive (TDI 1053, 1054), there are no cables between the formatter and the master drive. Cables are required for slave drives.

The remainder of this section gives the specification for the interface between the user and the TDI 1051 or 1052 tape drives. This is the industry standard interface for non-formatted tape drives.

For user to TDI 1053 or 1054 interface refer to Appendix C or the TDF 4050 Reference Manual, and for the interface between the user and the TDI 1050 refer to TDI drawing no. 01-30075.

Standard cabling requirements are: 18 pair twisted cables 26 AWG. The length of the twisted pair cables should be limited to 10 feet (3 meters).

Interface drivers and receivers consist of the networks shown in Figure 2-10.

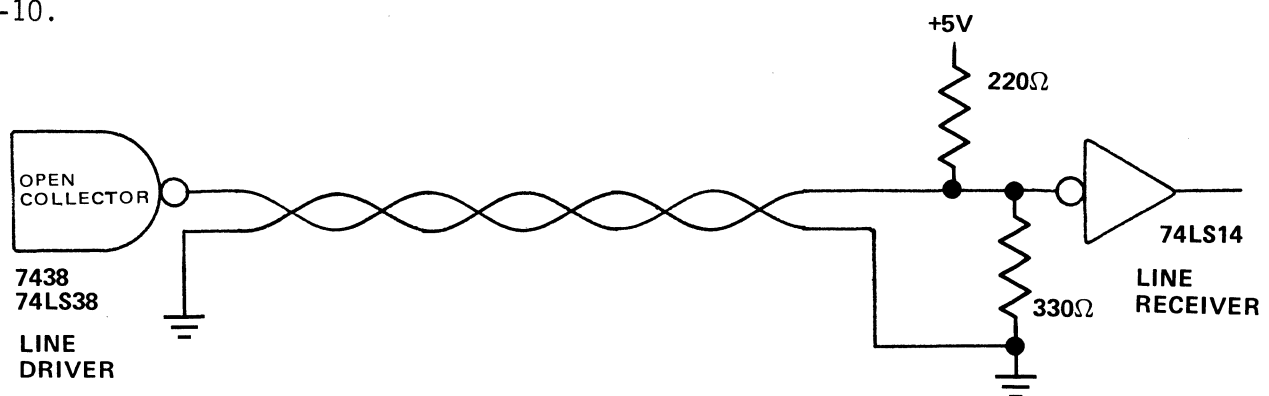


FIGURE 2-10. USER AND/OR TDI DRIVERS AND RECEIVERS

Interface Logic convention is low = true (0.7 Volts max.), false = high (2.0 Volts min.). Pulses are held true for a minimum of 2.0 microseconds.

## 2.9.2 Drive Interface

Table 2.3 gives the signal names and pin assignments for the interface between the TDI 1051, 1052 drive and the user. The same interface is used between slave drives and between the master 1053 drive and the first drive.

TABLE 2.3. INTERFACE CONNECTOR PIN ASSIGNMENTS,  
TDI 1051, 1052 CONTROLS AND STATUS

| PIN ASSIGNMENTS          |        | SIGNAL                                               |
|--------------------------|--------|------------------------------------------------------|
| LIVE                     | RETURN |                                                      |
| CONNECTOR J101 - CONTROL |        |                                                      |
| 1                        | -      | LOAD ON LINE ( $\overline{\text{LOL}}$ )             |
| B                        | 2      | OVERWRITE ( $\overline{\text{OVW}}$ )                |
| C                        | 3      | FORWARD Command ( $\overline{\text{FWD}}$ )          |
| D                        | 4      | DATA DENSITY SELECT ( $\overline{\text{DDS}}$ )      |
| E                        | 5      | REVERSE Command ( $\overline{\text{REV}}$ )          |
| F                        | 6      | DATA DENSITY INDICATOR ( $\overline{\text{DEN}}$ )   |
| H                        | 7      | REWIND Command ( $\overline{\text{RWD}}$ )           |
| K                        | 9      | WRITE ENABLE ( $\overline{\text{WRT}}$ )             |
| L                        | 10     | OFF-LINE Command ( $\overline{\text{OFL}}$ )         |
| M                        | 11     | ON-LINE STATUS ( $\overline{\text{ONL}}$ )           |
| N                        | 12     | REWIND STATUS ( $\overline{\text{REW}}$ )            |
| P                        | 13     | FILE PROTECT STATUS ( $\overline{\text{FPT}}$ )      |
| R                        | 14     | BEGINNING OF TAPE STATUS ( $\overline{\text{BOT}}$ ) |
| T                        | 16     | READY STATUS ( $\overline{\text{RDY}}$ )             |
| U                        | 17     | END OF TAPE STATUS ( $\overline{\text{EOT}}$ )       |
| J                        | 8      | DRIVE SELECT 0 ( $\overline{\text{SLT 0}}$ )         |
| A                        | -      | DRIVE SELECT 1 ( $\overline{\text{SLT 1}}$ )         |
| 18                       | -      | DRIVE SELECT 2 ( $\overline{\text{SLT 2}}$ )         |
| V                        | -      | DRIVE SELECT 3 ( $\overline{\text{SLT 3}}$ )         |

TABLE 2.3. INTERFACE CONNECTOR PIN ASSIGNMENTS,  
TDI 1051, 1052 CONTROLS AND STATUS (CONTINUED)

| PIN ASSIGNMENTS             |        | SIGNAL                                     |
|-----------------------------|--------|--------------------------------------------|
| LIVE                        | RETURN |                                            |
| CONNECTOR J102 - WRITE      |        |                                            |
| A                           | 1      | WRITE DATA STROBE ( $\overline{WDS}$ )     |
| C                           | 3      | WRITE AMPLIFIER RESET ( $\overline{WRS}$ ) |
| E                           | 5      | READ THRESHOLD 1 ( $\overline{TH1}$ )*     |
| F                           | 6      | READ THRESHOLD 2 ( $\overline{TH2}$ )      |
| L                           | 10     | WRITE DATA PARITY ( $\overline{WDP}$ )     |
| M                           | 11     | WRITE DATA 0 ( $\overline{WD0}$ )          |
| N                           | 12     | WRITE DATA 1 ( $\overline{WD1}$ )          |
| P                           | 13     | WRITE DATA 2 ( $\overline{WD2}$ )          |
| R                           | 14     | WRITE DATA 3 ( $\overline{WD3}$ )          |
| S                           | 15     | WRITE DATA 4 ( $\overline{WD4}$ )          |
| T                           | 16     | WRITE DATA 5 ( $\overline{WD5}$ )          |
| U                           | 17     | WRITE DATA 6 ( $\overline{WD6}$ )          |
| V                           | 18     | WRITE DATA 7 ( $\overline{WD7}$ )          |
| CONNECTOR J103 - READ       |        |                                            |
| 1                           | A      | READ DATA PARITY ( $\overline{RDP}$ )      |
| 2                           | B      | READ DATA STROBE ( $\overline{RDS}$ )      |
| 3                           | C      | READ DATA 0 ( $\overline{RD0}$ )           |
| 4                           | D      | READ DATA 1 ( $\overline{RD1}$ )           |
| 8                           | J      | READ DATA 2 ( $\overline{RD2}$ )           |
| 9                           | K      | READ DATA 3 ( $\overline{RD3}$ )           |
| 14                          | R      | READ DATA 4 ( $\overline{RD4}$ )           |
| 15                          | S      | READ DATA 5 ( $\overline{RD5}$ )           |
| 17                          | U      | READ DATA 6 ( $\overline{RD6}$ )           |
| 18                          | V      | READ DATA 7 ( $\overline{RD7}$ )           |
| * Given for reference only. |        |                                            |

TABLE 2.3. INTERFACE CONNECTOR PIN ASSIGNMENTS,  
TDI 1051, 1052 CONTROLS AND STATUS (CONTINUED)

| PIN ASSIGNMENTS                      |        | SIGNAL                    |
|--------------------------------------|--------|---------------------------|
| LIVE                                 | RETURN |                           |
| CONNECTOR J103 - READ (CONTINUED)    |        |                           |
| 10                                   | L      | NRZI STATUS (NRZI)        |
| 11                                   | M      | 7-TRACK STATUS (7TK)**    |
| 12                                   | N      | SINGLE GAP STATUS (SGL)** |
| 13                                   | P      | LOW SPEED STATUS (LSP)    |
| **Applicable to NRZI Operation only. |        |                           |

### 2.9.3 Drive Interface Description

#### LOAD ON LINE (LOL) (Option):

This is a pulse command which is enabled by removing jumper E28-E27 and installing jumper E24-E25. If tape is threaded, the drive will be made ready to receive controls from the interface.

#### OVERWRITE (OVW):

This is a level which must be true for a minimum of 20 microseconds after the leading edge of a FORWARD or REVERSE command and in conjunction with the WRITE ENABLE (WRT), causes the drive to perform an overwrite operation.

#### FORWARD (FWD):

This is a level. When true and the transport is ready and on line, the tape moves forward at the specified speed. When the level goes false, tape motion ceases. The start/stop velocity profile (ramp) is trapezoidal, with nominally equal rise and fall times.

## DATA DENSITY SELECT (DDS):

This drive control is active only when the option is enabled by removing jumper E29-E29 and inserting E30-E31. This level, when true, causes the transport to operate in the high-density mode. When false, transport operation will be in the low-density mode. If the remote density select option is not enabled the drive will operate in mode indicated by the front panel indicator.

## REVERSE (REV):

This is a level. When true and the transport is ready and on line, the tape moves in a reverse direction at the specified speed. When the level goes false, tape motion ceases. If the BOT marker is detected during a reverse, the reverse will be terminated. If a reverse command is given when the tape is at load point, it will be ignored.

### NOTE

When BOT is detected during reverse, the tape will not come to rest with the BOT marker in the same position as after a load sequence. The maximum variation possible is 1 inch.

## DATA DENSITY INDICATOR (DEN):

This level is true only when the transport is set for high-density operation.

## REWIND Command (RWD):

This is a pulse which, if the transport is ready and on line, causes the tape to move in reverse at 200 ips (average). When the tape passes the BOT tab, the rewind tape drive mode will cease, and the load sequence will be initiated automatically. If the tape is

already at load point when the REWIND command is given, the command will be ignored by the transport. If the remote unload option is enabled by removing jumper E21-E23 and installing jumper E21-E23; and if the tape is at load point, a REWIND command will unload the tape.

## WRITE ENABLE (WRT):

This level which must be true for a minimum of 20 microseconds after the leading edge of a FORWARD or REVERSE command when the write mode of operation is required. The leading edge of the FORWARD or REVERSE command (delayed 20 microseconds) initiates a sample of the WRITE ENABLE signal which results in setting the write/read flip-flop in the transport to the write state. The read circuits are enabled 4 milliseconds after the command. The write/read flip-flop will also be reset to the read state by the following:

- a. Rewind command while in on-line mode.
- b. Switching to off-line mode.
- c. Power fail or broken tape.

## OFF-LINE Command (OFL):

This is a level or pulse which sets the transport to the off-line condition, placing the transport under manual control. It is gated on the Interface Board only by SELECT, allowing an OFF-LINE command to be given while a rewind is in progress. An OFF-LINE command should be separated from a REWIND command by at least 2 microseconds.

## ON-LINE STATUS (ONL):

This is a line which is true when the drive is on-line. When true, the transport is under remote control. When false, the transport is under local control at the front panel.

## REWIND STATUS (REW):

This level is true only when the transport is engaged in any rewind operation including the load sequence following the BOT marker detection.

## FILE PROTECT STATUS (FPT):

This level is true if a supply reel is installed on the transport which has the write ring removed.

## BEGINNING OF TAPE STATUS (BOT):

This level is true when the BOT marker is under the photosensor, the transport is on-line, and not rewinding. After receipt of a FORWARD command, the signal will remain true until the BOT tab leaves the photosensor area.

## READY STATUS (RDY):

This level is true only when the initial load sequence is complete, the transport is on-line and not rewinding. The transport is ready to receive a remote command.

## NRZI STATUS (NRZI):

This line is true, indicates that the transport is operating in the NRZI mode. When false, this line indicates that tape transport is operating in the PE mode.

## 7-TRACK STATUS (7TK):

This level when true, identifies the selected TDI 1051, 1052 tape transport as a unit configured for 7-track operation.

## LOW SPEED STATUS (LSP):

This level when true identifies the selected TDI 1051, 1052 tape transport as a unit set to the lower speed of two possible speeds within a multiple drive system.

## END OF TAPE STATUS (EOT):

This level is true when the EOT marker is sensed by the photo-electric detector.

## DRIVE SELECT (SLT 0, SLT 1, SLT 2 and SLT 3):

Drive selection is accomplished when either  $\overline{\text{SLT 0}}$ ,  $\overline{\text{SLT 1}}$ ,  $\overline{\text{SLT 2}}$  or  $\overline{\text{SLT 3}}$  is true. All interface drivers and receivers in the addressed transport are connected to the controller. Only one drive select signal may be valid at a time. The address of a drive is determined via DIP (dual-in-line package) switch settings as described in Section II, Table 2.4.

## WRITE DATA STROBE (WDS):

This is a pulse generated by the controller (NRZI mode only) for each flux reversal to be written. The standard drive accepts data present on the write data line at the trailing edge of WDS. If jumper E39-E40 is removed and jumper E38-E39 is installed, data will be accepted on the WDS leading edge. Write logic then converts the NRZI format data and writes the character. In the Phase Encoded mode, data is presented on the write data lines and a write data strobe is required for each flux reversal to be written. The selected edge of this pulse starts the write process in the transport. It is assumed that the data lines have settled at least 0.5 microsecond before the selected edge of the pulse occurs and will remain steady until 0.5 microsecond after the selected edge of the WDS pulse.

## WRITE AMPLIFIER RESET (WRS):

This is a pulse. When true, it resets the write amplifier circuits on the leading edge. The purpose of this signal is to write the LRCC at the end of a record in the NRZI mode, causing the inter-record-gap (IRG) to be erased in reference direction. The leading edge of the WRS pulse will occur after eight character periods on



a nine-track transport (four character times on a seven-track transport), after the selected edge of the write strobe associated with the last data character. WRS is not used in the writing process for the Phase Encoded mode except for overwrite operations.

#### READ THRESHOLD 1 (TH1) AND SINGLE GAP STATUS (SGL):

These levels are given for reference only. TDI 1050 series drives are available in READ-AFTER-WRITE configurations only. Within the industry these lines are used with READ-WRITE (single gap) configurations only.

#### READ THRESHOLD 2 (TH2):

This level is used during read to select a lower than normal threshold. It is intended to be used when trying to recover data from tapes which cannot be read without error at the normal read level. It must be made true prior to the forward command. In no case should it be used for all reading since noise in the IRG may be detected causing positioning errors.

#### WRITE DATA (WDO through WDP):

These are levels which, if true from 0.5 microsecond before the selected edge of the write strobe to 0.5 microsecond after the selected edge of the write strobe will result in the recording of data if the transport is in the write mode.

#### **NOTE**

For the NRZI mode the CRCC is written by providing the correct character, together with a write strobe, four character times after the last data character of the record. The LRCC is written using the WRITE RESET (WRS) signal.

## READ DATA (RDP, RDO through RD7):

In the NRZI mode the individual bits of each data character are assembled into parallel form by a one-stage deskewing register. The complete character can be obtained by sampling these read data interface lines simultaneously during the read strobe period, (RDS). The read data lines prepared for the next character by resetting 0.5 microseconds after the trailing edge of the RDS. In PE mode these lines contain the phase encoded data read from tape. Although when reading new tapes on the same transport on which they were generated produces transition spacing within the drives tolerances, considerable variation should be expected when reading tapes of unknown age, use and origin. For NRZI mode the RDS and the corresponding read data lines can indicate, for any two adjacent characters, spacings from approximately 50% to +150% of the nominal spacing. For phase encoded tapes, deskewing logic should be capable of tracking variations up to  $\pm 50\%$  of the average spacing between two adjacent flux reversals.

## READ DATA STROBE (RDS):

This is a pulse for each data character read from tape. Note for the NRZI mode that the nominal time between adjacent RDS pulses averages  $\frac{1}{DV}$ , where D = density and V = tape velocity. When phase-encoded data is being read, a read data strobe is not available.

## 2.10 INTERNAL SWITCH AND JUMPERS

The TDI 1050 series transport is equipped with two DIP switches on the I/O Interface board and a series of lift-off jumpers on the main electronics board. The positions of these switches and jumpers are preset at the factory and normally require no further attention by the user. DIP switch functions are defined in Table 2.4. The functions of the available jumper connections are listed in Table 2.5. Both tables show the as-delivered configuration.

TABLE 2.4. STANDARD TDI 1051, 1052 DIP SWITCH FUNCTIONS

| SWITCH | POSITION | FUNCTION (ON)                                                         | AS DELIVERED |
|--------|----------|-----------------------------------------------------------------------|--------------|
| 1L     | 1        | Provides +5V power to pin S of P101 when external power is re-quired. | OFF          |
|        | 2        | Provides ON LINE and SELECT gating (OFF provides SELECT-ONLY gating)  | ON           |
|        | 3        | UNUSED                                                                | OFF          |
|        | 4        | UNUSED                                                                | OFF          |
|        | 5        | Enables SELECT 0                                                      | ON           |
|        | 6        | Enables SELECT 1                                                      | OFF          |
|        | 7        | Enables SELECT 2                                                      | OFF          |
|        | 8        | Enables SELECT 3                                                      | OFF          |
| 1E     | 1        | UNUSED                                                                | OFF          |
|        | 2        | Establishes low speed status to computer                              | OFF          |
|        | 3        | Establishes single gap status to computer                             | OFF          |
|        | 4        | Establishes 7 TK gap status to computer                               | (per order)  |

TABLE 2.5. MAIN ELECTRONICS BOARD JUMPER FUNCTIONS

| JUMPER       | FUNCTION                        | AS DELIVERED IN/OUT<br>(9-TRACK VERSION) |
|--------------|---------------------------------|------------------------------------------|
| E4 to E5     | Test Option 3                   | IN (Disabled)                            |
| E13 to E14   | Test Option 2                   | IN (Disabled)                            |
| (E7, E8, E9) | Power On Reset Disable          | OUT (Enabled)                            |
| E10 to E12   | Off Line Test Mode              | IN (Disabled)                            |
| E16 to E17   | Test Option 1                   | IN (Disabled)                            |
| E21 to E22   | Remote Unload                   | IN (Disabled)                            |
| E26 to E27   | LOL Disabled                    | IN                                       |
| E24 to E25   | LOL Enabled                     | OUT                                      |
| E34 to E35   | Dual Stack Head                 | IN (Enabled)                             |
| E36 to E37   | 7TRK/800 BPI                    | OUT (Disabled)                           |
| E28 to E29   | Density Select from Front Panel | IN (Enabled)                             |
| E30 to E31   | Remote Density Select           | OUT (Disabled)                           |
| E32 to E33   | Fixed 1600 CPI Density          | OUT (Disabled)                           |
| E39 to E40   | Trailing Edge WDS               | IN (Enabled)                             |
| E2 to E3     | Test Capability                 | IN (Disabled)                            |

### 2.11 RESHIPMENT

When reshipment of a TDI System becomes necessary, it should be packed in the shipping containers in which it was delivered in accordance with the following procedure:

1. Remove unit from system installation.
2. Attach shipping frame.

## CAUTION

When attaching the tape transport to the shipping frame, remove all obstructing objects (pawl fastener; interface cables; etc.) between the top plate and the shipping frame. If the attaching screws are tightened when an obstruction is present, breakage or severe warping of top plate may occur.

3. If the tape transport is to be packed for shipping purposes, use the original shipping carton.
4. After sealing the first carton, tape the four corner pads in place. Slip outer carton over inner carton.
5. Secure outer carton. Prepare for shipment.

### 2.12 SUBSTITUTE SHIPPING CONTAINER

If the shipping frame but not the original container is available, a suitable substitute may be constructed as follows:

1. Select a heavy carton of correct size to snugly accept the transport.
2. Place the first carton in a large carton with a minimum clearance of 2-inches all the way around.
3. Pack carton with foam on all six sides or use preformed corner pads.
4. Seal outer carton, prepare for shipment.

## WARNING

DO NOT attempt to ship the transport without the shipping frame.

**TANDBERG**

**SECTION III  
OPERATIONS**

**PUBLICATION NO. 00-10001**

## SECTION III

## OPERATIONS

## 3.1 INTRODUCTION

This section contains a description of the controls and indicators and the operating instructions for the TDI 1050. A thorough knowledge of this section will enhance the user's operational and maintenance capabilities.

## 3.2 CONTROLS AND INDICATORS

The TDI 1050 is equipped with a complete set of controls and indicators for local operation. The switch assembly, shown in Figure 3-1, is located directly above the dust cover door. The power switch is a U.L. approved device which is a latch-in-position, lighted-when-on switch. Six additional momentary push button switches are provided for: LOAD, ON LINE, REWIND, 1600 CPI, FORWARD and RESET. WRITE ENABLE is an indicator which illuminates when write ring is installed on the supply reel and an initial load operation is entered. The functions of these switches and indicators are defined in Table 3.1. It should be noted, when in the test mode, the function of these switches are redefined. (Test functions are described in the Test Section.)

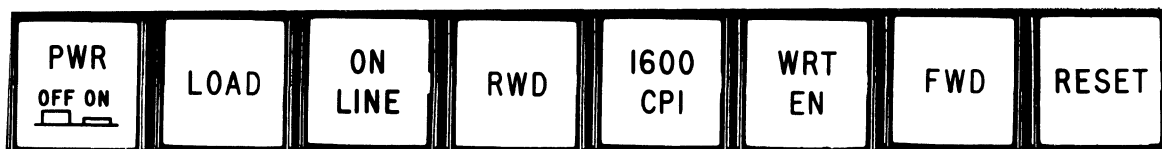


FIGURE 3-1. CONTROLS AND INDICATORS

TABLE 3.1. CONTROL AND INDICATOR FUNCTIONS

| INDICATOR/CONTROL | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| POWER             | Alternate-action indicator switch. Lighted button signifies that line power is applied, switch remains depressed when activated.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| LOAD              | <p>Momentary-closure indicator switch. Lighted switch signifies that tape is positioned at load point. Activation of switch immediately after power application initiates the following actions:</p> <ol style="list-style-type: none"> <li>1. Compliance arm retractor lowers arms to the operating position and tension is applied to the tape.</li> <li>2. Forward tape motion occurs at approximately 40 inches per second.</li> <li>3. Tape motion halts upon detection of load point with the BOT mark in the photo sensor. If the BOT mark is not found within 10 seconds, motion switches to rewind until load point is detected. Load mode is then re-entered and tape is positioned at load point.</li> <li>4. Tape transport is now on-line and ready to accept external commands. LOAD and ON LINE indicators should be lighted.</li> </ol> <p>LOAD switch is disabled after the initial load sequence. Load sequence may be halted by pressing RESET.</p> |



TABLE 3.1. CONTROL AND INDICATOR FUNCTIONS (CONTINUED)

| INDICATOR/CONTROL | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ON LINE           | Momentary-closure indicator switch. Indicator lights at end of initial load sequence to indicate that transport is on-line and ready to accept external commands. When ON LINE is activated, all controls except RESET and POWER are disabled. To make the Drive off-line and activate panel controls, press the RESET switch. Transport can be returned to an on-line condition by pressing ON LINE switch.                                               |
| REWIND            | Momentary-closure indicator switch. Indicator lights during rewind sequence. If tape is not at load point, activation of switch causes tape to rewind until load point is detected. Motion halts, then tape is repositioned to load point and rewind sequence is terminated. If tape is at load point activation of REWIND causes the unloading of tape to the supply reel. REWIND switch can be activated only while ON LINE indicator remains unlighted. |
| 1600 CPI          | Momentary-closure indicator switch. Lighted indicator signifies that transport is operating in 1600 CPI (characters per inch) phase-encoded mode. Unlighted indicator signifies that transport is operating in NRZI mode. The switch is enabled by first depressing RESET. 1600 CPI, NRZI mode can also be selected by pressing 1600 CPI.                                                                                                                  |

TABLE 3.1. CONTROL AND INDICATOR FUNCTIONS (CONTINUED)

| INDICATOR/CONTROL | DESCRIPTION                                                                                                                                                                                                                                                                                                                            |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| WRITE ENABLE      | Indicator only. Signifies that write enable ring is present in tape supply reel.                                                                                                                                                                                                                                                       |
| FORWARD           | Momentary-closure indicator switch. Indicator lights when tape motion is in forward direction. When transport is off line, FORWARD switch can be used to initiate forward tape motion; press RESET to halt motion. Tape will stop when EOT mark is detected.                                                                           |
| RESET             | Momentary-closure switch. Used to activate following functions: <ol style="list-style-type: none"> <li>1. Take transport off line.</li> <li>2. Halt rewind tape motion.</li> <li>3. Use with 1600 CPI switch to change operating mode.</li> <li>4. Halt forward tape motion if motion has been initiated by FORWARD switch.</li> </ol> |

### 3.3 TAPE LOADING PROCEDURE

When loading tape on the TDI 1051, the supply reel is mounted on the bottom hub, and the upper hub serves as the take-up reel. The maximum supply reel size is 10.5 inches in diameter. Recording can be accomplished only when the write-enable ring is installed in the supply reel. Figure 3-2 illustrates the required tape path.

### 3.3.1 To Load Tape

- a. Open the dust cover door and lift the reel retention lever on the lower hub.
- b. Press the supply reel against the back flange of the hub and push the reel retention lever back into position.
- c. Thread the magnetic tape over the path shown in Figure 3-2. It will be necessary to push the flux gate to the left when routing the tape through the head assembly.
- d. Wrap the tape leader onto the take-up hub to allow winding with a clockwise rotation. Wind several turns onto the take-up hub.

### 3.3.2 Advancing Tape to Load Point

After the magnetic tape has been threaded in accordance with paragraph 3.3.1, it must be advanced to the load point using the following procedure:

- a. Depress PWR, then LOAD switch. The tape will move in the forward direction until the load point is detected.
- b. Verify that the tape halts and the LOAD and ON LINE indicators are lighted. The tape is now positioned at the load point and the transport is ready to receive external commands.

#### CAUTION

The dust cover door should remain closed while the tape is loaded. Performance may be adversely affected by contamination.

### 3.3.3 Tape Removal Procedure

To unload the magnetic tape from the transport, perform the following procedure:

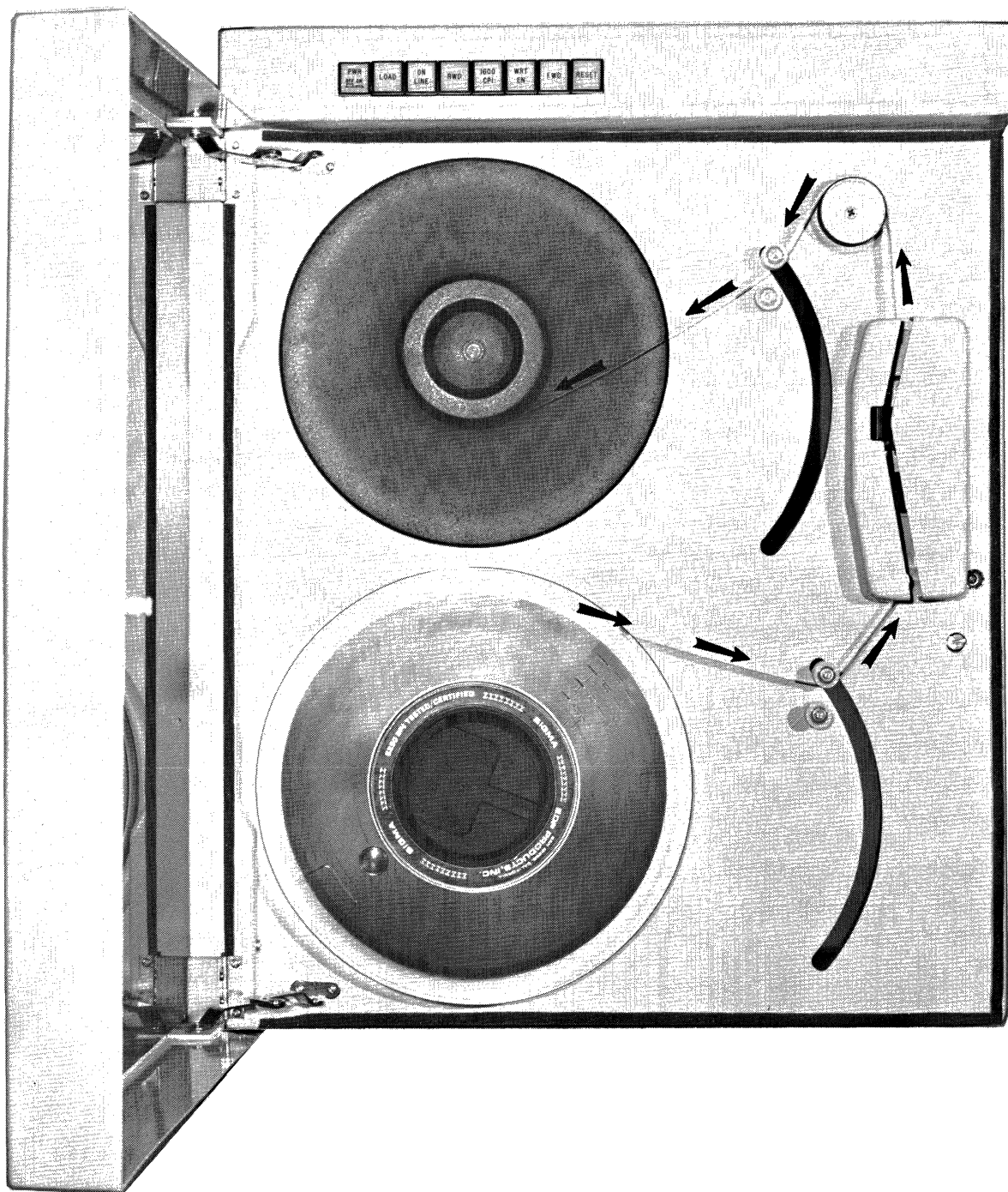


FIGURE 3-2. MAGNETIC TAPE PATH DURING THREADING  
(Compliance arm retracted)

**NOTE**

If the PWR indicator is lighted, begin at step b.

- a. Depress the PWR switch and verify that the PWR indicator lights. Depress the LOAD switch and allow load sequence to terminate.
- b. Depress RESET, then REWIND switch. After the tape halts at the load point, depress REWIND again; tape will rewind onto the supply reel, then motion will halt.
- c. Depress the PWR switch. Remove the supply reel by lifting the reel retention lever.



TANDBERG

SECTION IV  
THEORY OF OPERATION

PUBLICATION NO. 00-10001

## SECTION IV

### THEORY OF OPERATION

#### 4.1 INTRODUCTION

Basic operational theory describing the TDI 1050 is given in this section.

The TDI 1050 is a compliance-arm type synchronous digital tape transport which generates and reads ANSI, IBM and ECMA compatible tapes in both PE and NRZI formats and in both 7-track and 9-track versions. In all cases, data format and computer interface requirements are performed by electronics not provided with the basic model. However, an integral formatter is incorporated with the TDI 1053 and 1054 models. The scope of this discussion is limited to the model TDI 1050.

#### 4.2 DESCRIPTION

Performance specifications applicable to the TDI 1050 are shown in Table 4.1. Provisions within the unit permit operation with or without daisy-chain capabilities.

Magnetic tape units are peripheral components in data processing systems requiring storage and retrieval of vast amounts of data without errors. The TDI 1050 has been designed for easy operation with industry compatible interface standards and simple maintenance. Safeguards are built-in for tape handling protection during normal operation.

Mechanical and structural integrity are developed by a single-casting, strain relieved top plate, which supports all mechanical and electrical



TABLE 4.1. MECHANICAL AND ELECTRICAL SPECIFICATIONS

|                                                                |                                                                        |
|----------------------------------------------------------------|------------------------------------------------------------------------|
| <b>Tape (Computer Grade)</b>                                   |                                                                        |
| Width                                                          | 12.649 ± 0.051 mm (0.498 ± 0.002 inch)                                 |
| Thickness                                                      | 38.1 microns (1.5 mil)                                                 |
| <b>Tape Tension</b>                                            | 2.224 ± 0.139N (8.0 ± 0.5 ounces)                                      |
| <b>Reel Diameter</b>                                           | 26.67 cm (10.5 inches) maximum                                         |
| <b>Reel Capacity (38.1 micron tape)</b>                        | 731.52 m (2,400 feet)                                                  |
| <b>Recording Mode (IBM, ECMA and ANSI)</b>                     | 9-track 630 c/cm (1600 cpi) PE or 315 c/cm (800 cpi) NRZI              |
| <b>Standard Tape Speeds</b>                                    | 114.3, 95.25, 63.5, 47.625, 31.75 cm/s (45, 37.5, 25, 18.75, 12.5 ips) |
| <b>Instantaneous Speed Variation</b>                           | ± 3%                                                                   |
| <b>Long Term Speed Variation</b>                               | ± 1%                                                                   |
| <b>Rewind Speed</b>                                            | 5 m/s (200 ips) average, 10.5 inch reel                                |
| <b>Interchannel Displacement Error</b>                         |                                                                        |
| Read                                                           | 2.54 microns (100 μ in)                                                |
| Write                                                          | Electronically Compensated                                             |
| <b>Start/Stop Displacement</b>                                 | 4.826 ± 0.5080 mm (0.19 ± 0.02 inches)                                 |
| <b>Beginning of Tape (BOT) and End of Tape (EOT) Detectors</b> | Photoelectric<br>IBM Compatible                                        |
| <b>Weight</b>                                                  | 38.56 kg (85 pounds)                                                   |
| <b>Dimensions</b>                                              |                                                                        |
| Height                                                         | 30.47 cm (12.0 inches)                                                 |
| Width                                                          | 48.26 cm (19.0 inches)                                                 |
| Depth (from mounting surface)                                  | 36.195 cm (14.25 inches)                                               |
| Cable Clearance                                                | 5.08 cm (2 inches)                                                     |
| <b>Operating Temperature</b>                                   | 2°C to 50°C (36°F to 122°F)                                            |
| <b>Non-Operating Temperature</b>                               | -45°C to 71°C (-50°F to 160°F)                                         |
| <b>Operating Altitude</b>                                      | 0 to 6,096 m (0 to 20,000 feet)                                        |
| <b>Non-Operating Altitude</b>                                  | 0 to 15,240 m (0 to 50,000 feet)                                       |
| <b>Power</b>                                                   |                                                                        |
| Volts ac                                                       | 100, 120, 220, 240 ± 10%                                               |
| Power (maximum on high line and worst case command rate)       | 300 Watts                                                              |
| Frequency                                                      | 48 to 400 Hz                                                           |
| <b>Mounting</b>                                                | Standard EIA Rack, 19-inch vertical or 24-inch horizontal              |
| <b>Electronics</b>                                             | All Solid State, Standard Parts                                        |

components. Uniform tape tension is maintained over all dynamic operating ranges up to tape speeds of 45 inches-per-second (IPS) by two compliance arms and reel control servo loops of superior performance.

Normal operation of the tape unit is under computer control. When the tape unit is off-line, tape motion may be locally controlled by the operator with push buttons on the front of the machine. Indicator lights provide status information which identify specific system operating conditions.

Speed and tape movement direction is determined by the capstan servo in response to computer or local commands. For proper operation, the tape must be accelerated, traversed, and decelerated in a precise manner. The inertia of the tape on the reels prevents the reels from starting as quickly as the capstan, therefore a length of tape is stored in two loops over spring actuated compliance arms. Rapid tape acceleration or deceleration is compensated by shift in position of the low-inertia compliance arms during the time required for reels to match capstan motion, while maintaining tape tension across the head.

Reflective markers affixed near either end of the tape are photo-electrically sensed to prevent either end from being pulled from the reel, except when the tape is unloaded by the operator. This sensor station indicating end-of-tape (EOT) or beginning-of-tape (BOT) is located near the read/write head assembly. Status lines are provided, indicating the type of marker to the computer

To assure that data on tape will be read correctly, the tape is cleaned just before passing over the head. The tape cleaner is a pair of ceramic blades which scrape dirt or oxide deposits from the tape.

TDI 1050 operating principles are covered by the following paragraphs in order of the major functional blocks, which are:

1. Power Supply
2. Capstan Drive
3. Reel Drive
4. Control Electronics
5. Data Electronics

#### 4.3 POWER SUPPLY (DWG. No. 10-20075, Sheet 1)

Developing power for the complete synchronous tape transport are the following power supply subassemblies:

- External AC power input filters - Provides common-mode powerline noise filtering and selectable voltage taps.
- Transformer (T1) and Rectifier (CR1) - Which develop the raw DC power.
- Filters (PCB Assy. 11-00086) - DC filters.
- Regulators - Located on a heat sink mounted to the main electronics printed circuit board.
- Power Switch (PCB Assy. 11-00032) - Located on the control panel.

Unregulated DC power is switched by a front panel switch through a TRIAC (Q1) located on the Power Supply PCB Assembly. Regulators provide the necessary source voltage levels for the entire unit. Models including the TDF-4050 formatter are supplemented with an independent transformer winding (9 VAC, 6 Amps), and separate regulator.

#### 4.4 CAPSTAN DRIVE (DWG. No. 01-30075, Sheet 2)

Tape motion is implemented by a DC-motor driven capstan. When the motor is running, tachometer DC voltage feedback stabilizes tape velocity with the capstan servo. Tape velocity is set to standard speed by potentiometer R6 and R11 for forward and reverse motions respectively. Steady state tachometer output voltage levels measured during initial adjustments establish the exact

potentiometer settings for the specific standard tape speed. When stopped, capstan drift is nulled by potentiometer R78 (Refer to Section 7.6.3 for setting procedures.)

Initial tape loading motion is developed by switching a fixed offset voltage level into the capstan servo summing point. Tape velocity is about 60 IPS (inches per second) during loading and tape velocity ramp circuits are not used.

One bidirectional ramp generator is used in the capstan servo. Forward motion is developed by switching a positive reference voltage into the ramp generator. A precision integrator computes the ramp slope, based on the setting of R22. This establishes the start and stop distances which partially determines the inter-block-gap (IBG) dimension in accordance with tape format standards. Once the ramp generator sets the capstan in motion, slack tape is collected by the compliance arms. Differential photo-electric sensor elements read the change of compliance arm position, which is converted into a proportional drive to both takeup and supply reel servos. Since the compliance arm and reel servo loop stiffness is relatively low, start and stop commands result in large compliance arm excursions. Therefore, reel motor action is started simultaneously with the ramp function using the compliance arm offset (COS) generator (Refer to device 9H). Operation of the COS generator is such that compliance arm position during tape motion is optimized to an offset from nominal which provides greater arm travel during stopping dynamics.

Either a forward or reverse command ( $\overline{FWC}$  or  $\overline{REC}$ ) to the interface is sampled by the 3870 microprocessor, which sets the FWDA or REVA transistor (Refer to 11J), which switch the appropriate reference voltage into the ramp generator. Figure 4-1 shows typical capstan servo waveforms.

Rewind action, when commanded, occurs through the 3870 supervising control. Analog switches are activated in the rewind circuit, initiating capstan action. Signals CAPN and RWHA (Capstan ON and Rewind Halt) are normally logic

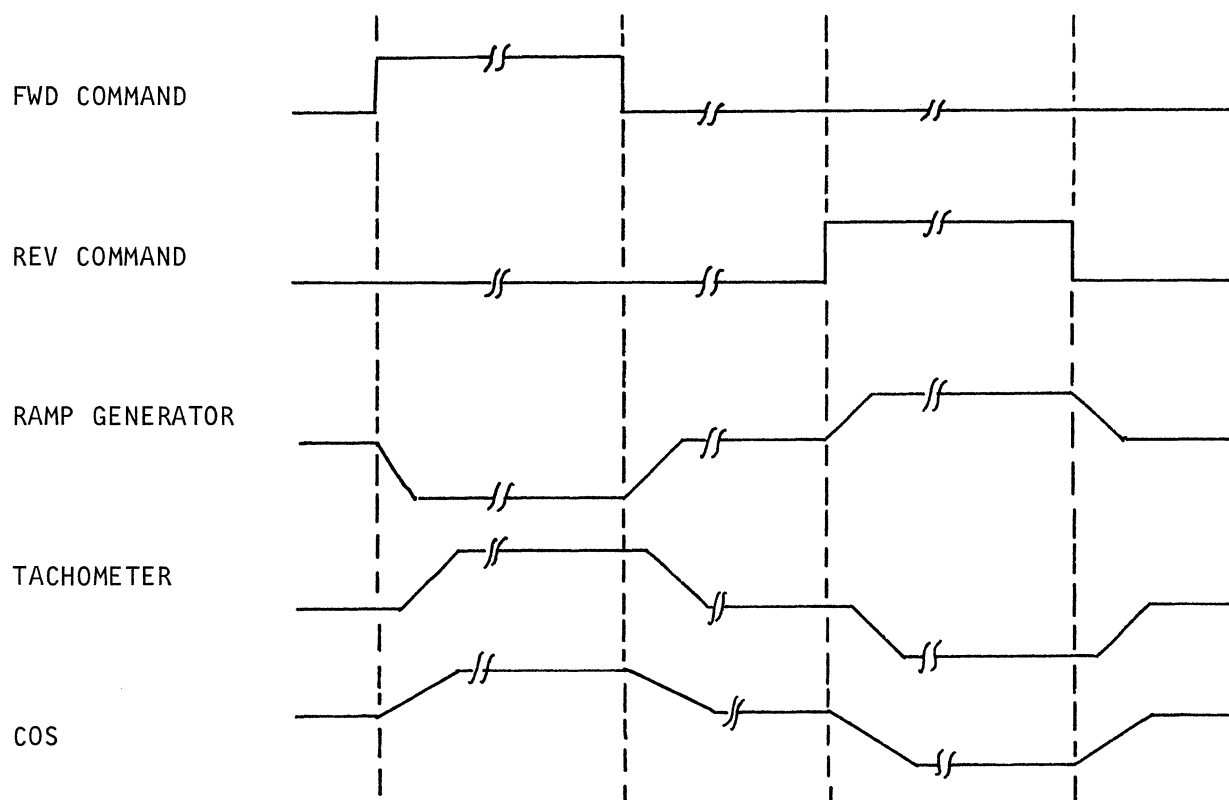


FIGURE 4-1. CAPSTAN SERVO WAVEFORMS

TRUE, except during rewind. To initiate rewind, CAPN and RWHA are set FALSE while CAPR and RWDA are TRUE, feeding a reference voltage level via the transistor switch at 10J-16 through integrator 12J-8 and switch 10J-8 into the capstan servo summing point at 9J-2. Rewind drive voltage continues to increase and the reels gain speed until at least one compliance arm moves to a position which trips the half-arm-travel-limit (HATL) sensing circuit (6J-8). The HATL polarity counterbalances the rewind reference voltage to prevent reel speed increase without bound. Average rewind speed is about 200 IPS.

When the BOT marker crosses the sensor, the 3870 detects the event and immediately returns RWHA logic signals to normal ON state, which also turns RWHA OFF. The reels slow to a stop under control of the decaying control voltage provided by integrator 12J-8. Tape motion condition is indicated by

a window comparator (8H-1) operating on the capstan tachometer output. Motion logic (M0) is FALSE when the tape has stopped, whereupon CAPR is turned OFF and CAPN ON enabling LOAD, forward motion as commanded by the 3870 until BOT is sensed and the tape stopped at loadpoint, completing the rewind sequence.

At loadpoint, it is possible to unload the tape when the transport is OFF LINE. OFF LINE condition is obtained by manually depressing RESET on the front panel, which branches the 3870 into a subprogram that monitors other panel switches. Depressing REW while at loadpoint (LOAD is illuminate) activates the unload position output (ULP, 8J-5) from the 3870. Capstan reverse motion is initiated and the compliance arms are lowered close to the lower bumpers. The arms fall lightly on the bumpers when tape slacks from the take-up reel. Withdrawal of the tape through the EOT/BOT sensor station near the head is sensed and the ULP turned OFF. At this time the fail-safe-relay (FSR, K1) is de-energized, which shorts the reel motor windings, providing dynamic braking. Following this, the retractor motor is started to move the compliance arms to the initial loading position. The unload sequence is complete and the tape may be manually dismounted from the supply reel.

#### 4.5 REEL DRIVE (DWG. No. 01-30075, Sheet 2)

Two servo loops control the supply and take-up reels. Storage of reserve tape lengths is provided by the compliance arms, which permit the capstan to accelerate more rapidly than the higher-inertia reels.

Compliance arms are position sensed photo-electrical for input to the reel servos. During loading, the FSR is turned on and the retractor motor started to lower the compliance arms. During this time, the reel servos tension the tape in place due to a control voltage supplied from transistor switch Q52. Completion of the retractor cycle turns Q52 OFF and asserts the normal reel servos operation. The loading sequence continues as the 3870 initiates a search forward motion until the BOT marker is sensed. At BOT, tape motion sequence is terminated and ON LINE mode is initiated, which places the transport under computer control and deactivates all but RESET and POWER

panel switches. Reel servos are controlled in ON LINE mode by capstan action.

#### 4.6 CONTROL ELECTRONICS

The block diagram for the TDI 1050 control system is shown in Figure 4-2. Commands and status at the external interface are interpreted in accordance with the digital control section. Refer to Section 2.9 for interface signal description.

The purpose of this section is to describe the conversion process between the digital interface controls given in Section 2.9 and the analog components which respond to control stimuli.

Principal components which implement the transport control functions are the 3870, single chip, 8-bit Central Processor Unit (CPU). The 3870 executes F8 instructions, consisting of a set of more than 70 commands. Integrated on the single MOS circuit device are 2048 bytes of read-only memory (ROM), 64 bytes of scratch pad random-access memory (RAM), a programmable timer and 32 basic I/O lines arranged as four 8-bit ports. The I/O capability of these four ports is expanded using multiplexing devices to include 30 input lines and 23 discrete output control lines, totaling 53 I/O lines. The functions of the control program stored in the 2048 bytes of ROM is to sense each input and manipulate each output line in accordance with the current machine state. Figure 4-3, shows all the digital control section inputs and outputs, identified by appropriate mnemonics.

Principles of operations may be examined by referring to the program flow diagram (Figure 4-4) for the condition when the transport is ON LINE and under computer control. Tape loading procedures conclude with the BOT marker positioned just in front of the head and the transport ON LINE, which enters the program flow at the point identified by the READY label in Figure 4-4. Initialization of the various control lines is performed, following which the GO input line is continuously sampled until either a reverse

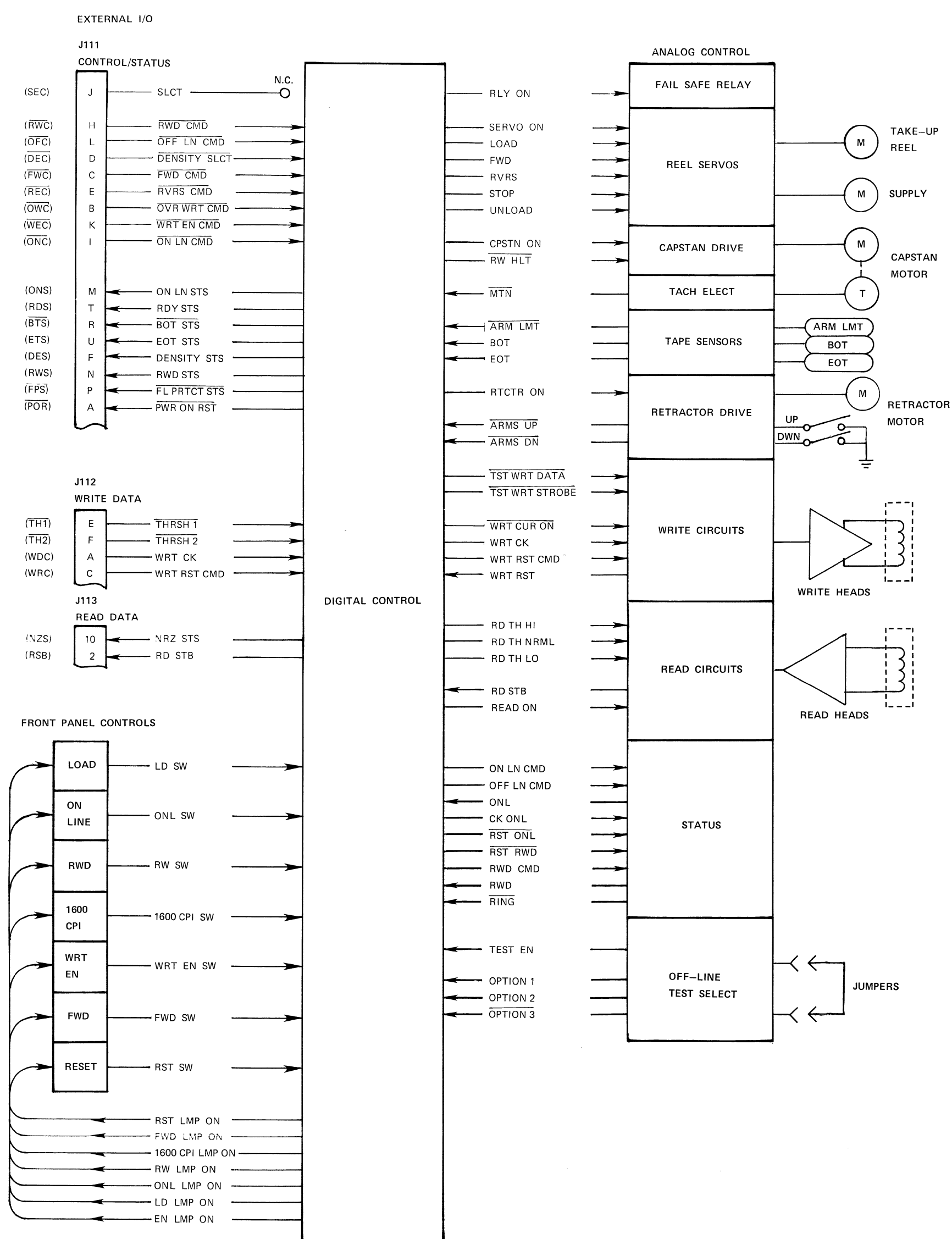


FIGURE 4-2. TDI 1050 CONTROL





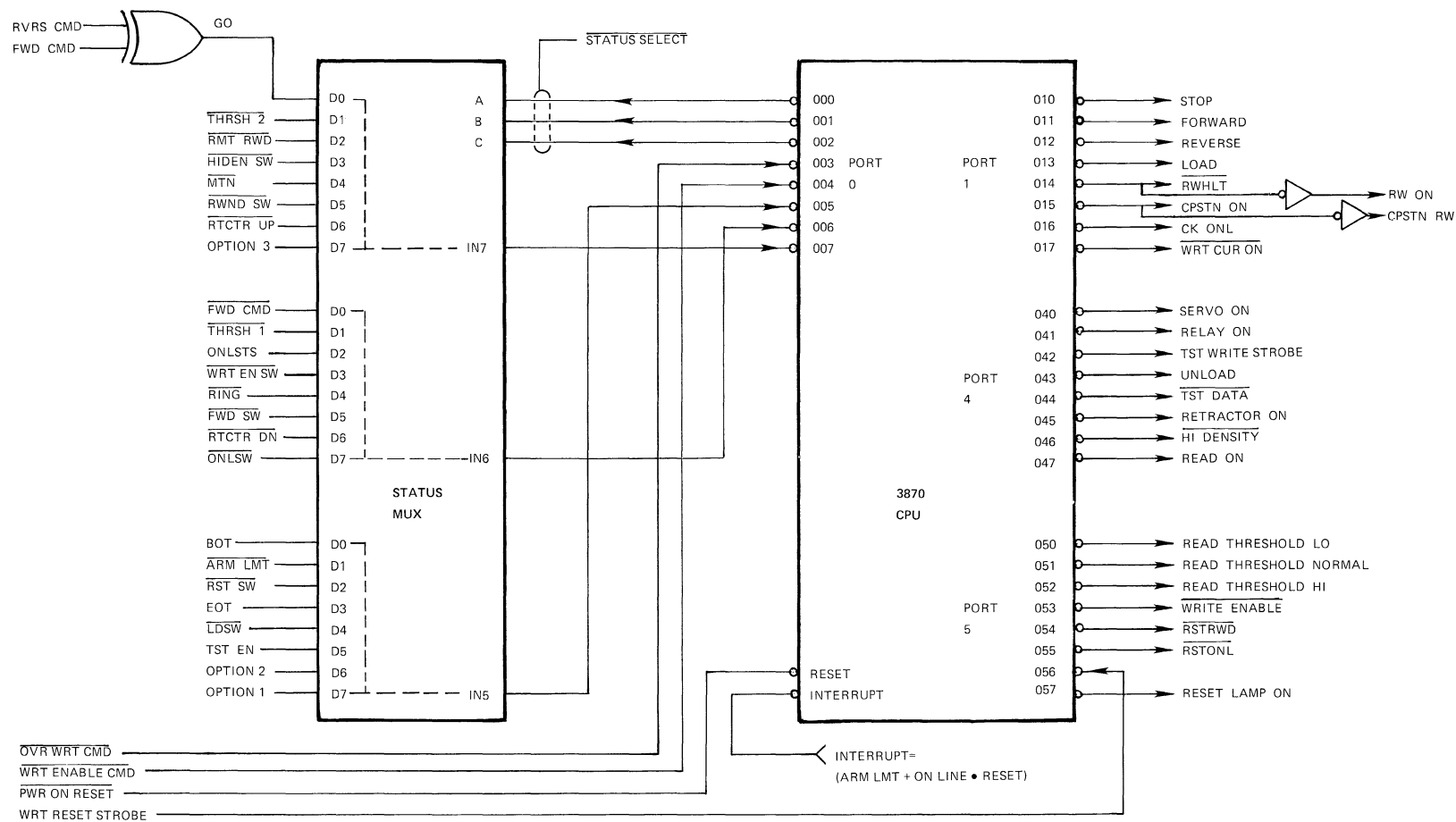


FIGURE 4-3. MICROPROCESSOR I/O FUNCTIONS

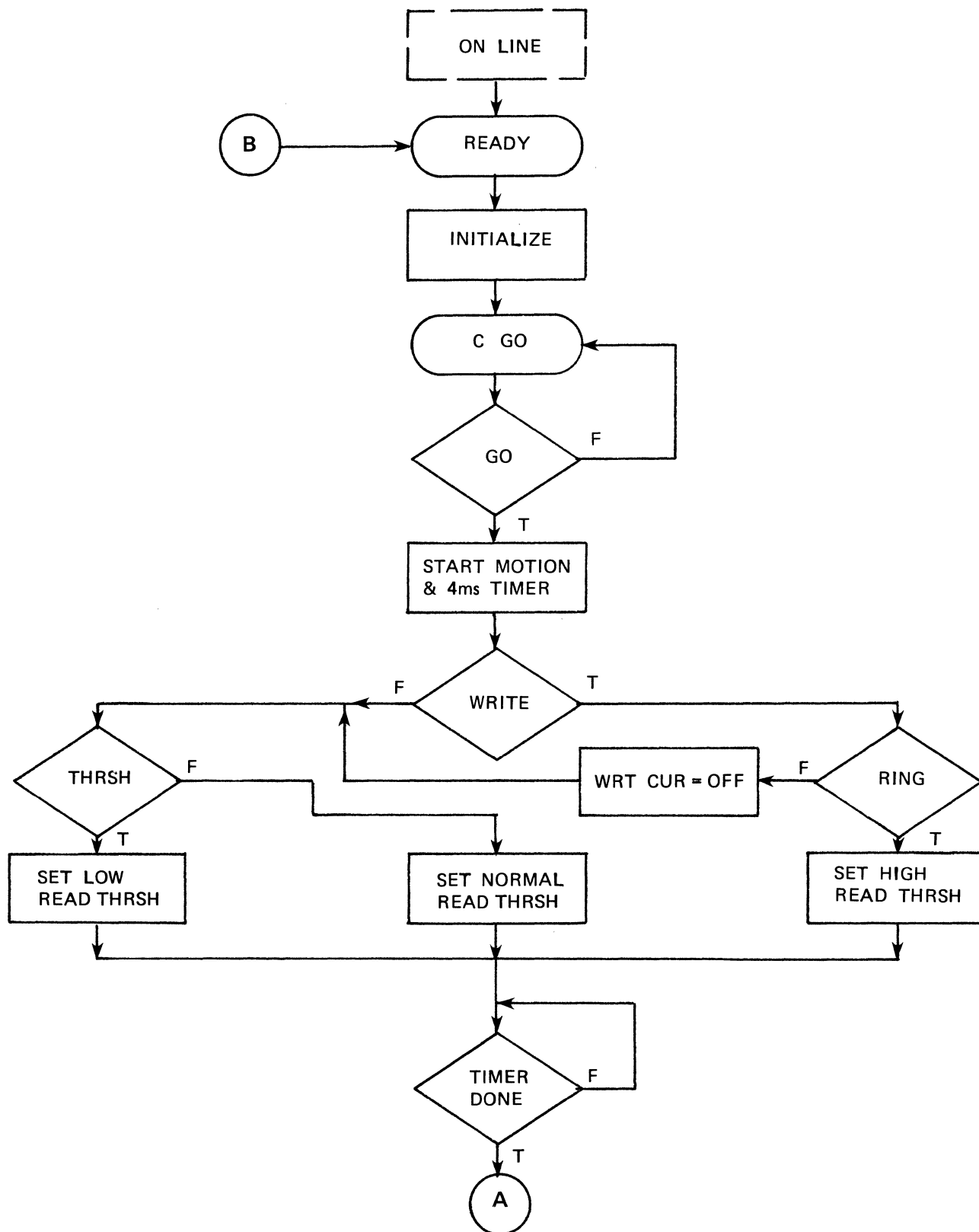


FIGURE 4-4. PROGRAM FLOW, ON LINE

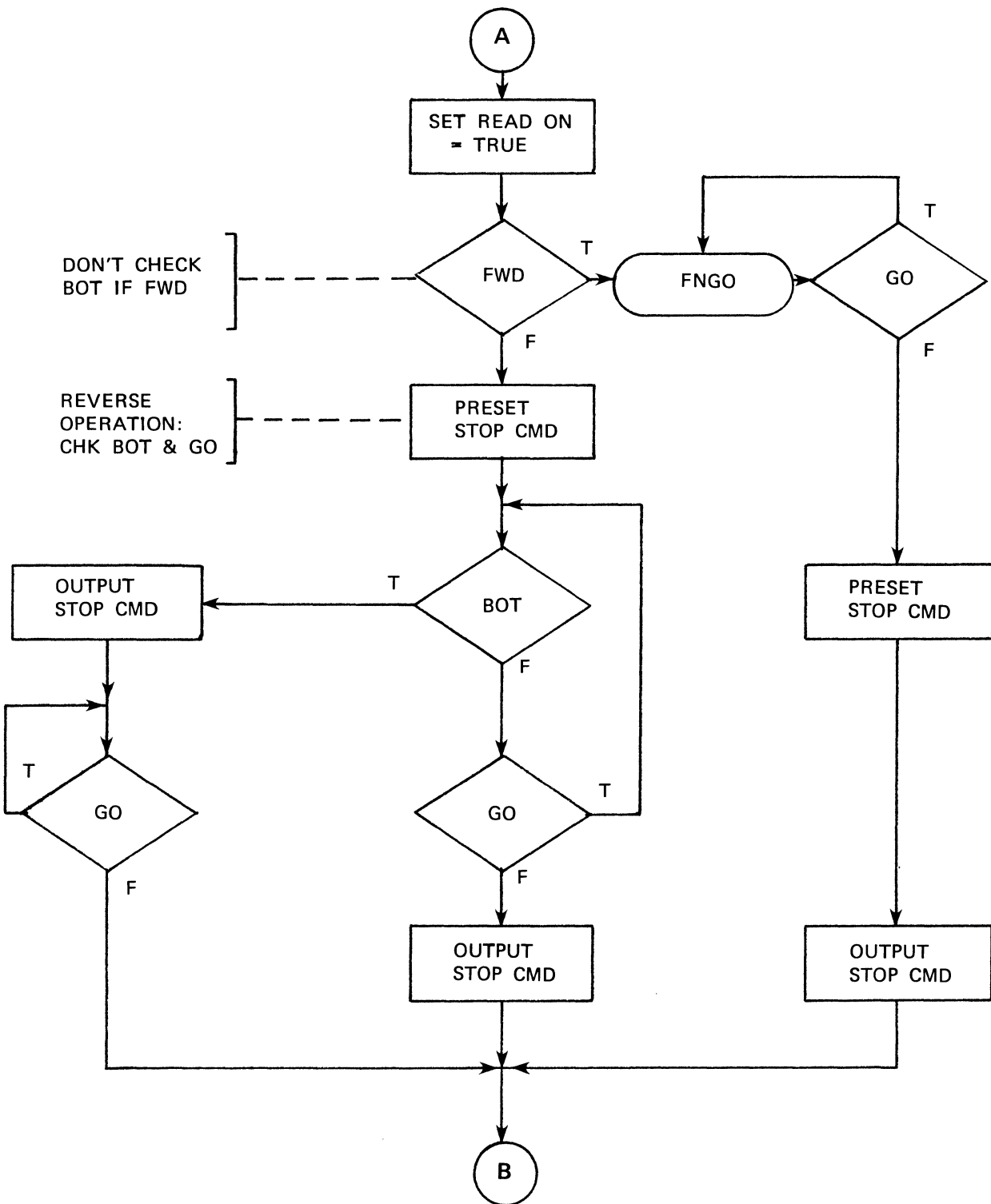


FIGURE 4-4. PROGRAM FLOW, ON LINE (CONTINUED)

or forward command is activated at the external interface. Tape motion is immediately started. The write enable command line is tested and then the write enable ring is tested. If the command is write and the ring not installed, the write head current switch is disabled and normal read mode executed. If the ring is installed, read threshold is automatically set high for stringent read-after-write testing.

After read threshold setting, the CPU waits until the 4 millisecond timer has expired, sets the READ circuits ON and samples the FORWARD command line. If tape motion is forward, no check for BOT is performed; otherwise the tape is moving in reverse direction and must stop if BOT is sensed. GO is always checked for both directions to stop motion at end-of-record. Verification of GO = FALSE loops the program to the initialize block, ready for the next command.

Control outputs from the CPU to the analog control section are the result of program operation which sets each particular output either ON or OFF. Analog controls respond and analog-to-digital conversion is performed by various limit comparators and input to the program as status bits, forming a closed-loop, microprogrammable control system. Various self-protective features are integrated with the status. Broken or misthreaded tape will result in out-of-range compliance arm travel which will interrupt the program and stop the system. Loss of power or failure of a tape position sensor will also stop the system.

Power-fail/recovery is possible with the load-on-line (LOL) command option. In the event of a power outage and return the computer may issue LOL. This causes the transport to automatically regain tape tension and go ON LINE, ready for normal operation without rewinding to load point.

Supplementary off-line testing capability is provided within the 2048 bytes of ROM program. (Refer to Section VII, Testing.) These tests exercise all portions of the TDI 1050 and enhance field service capabilities with minimum external test equipment.

## 4.7 DATA ELECTRONICS (DWG. No. 10-30075, Sheets 4 and 5)

A dual gap read-after-write head is supplied with a full width erase head. The write and read stacks are center tapped.

Write data waveforms are developed and electronically deskewed prior to transferring the waveforms to the head. The trailing edge of the write strobe (WDC) loads the write register, the contents of which are converted into individual track write currents when clocked from the deskewing circuit. Taps, set at the factory, determine the write current timing per character on each track; compensating for write gap lateral position variations on tape from track to track.

The write register is DC reset at certain times to ensure that the writing currents are always initially in the erase conditions. The logic created for this is such that a FALSE condition for Write Enable (WEC) or TRUE for Write Reset Command (WRC) will perform the DC reset.

Flow of power to write and erase heads is controlled by the CPU as discussed previously.

Read heads convert magnetic flux changes on tape to low level analog signals proportional to tape speed. The read recovery electronics shape the analog signals into digitized signals. This is accomplished by linearly amplifying the read head signal to a suitable operating level and then differentiating to convert peaks to zero crossover points. Next, zero crossover detection is accomplished by hard limiting. The limiter output is routed directly to the output for PE mode. NRZI mode limiter outputs are electronically deskewed prior to generating the read strobe (RSB) to the external interface. (Read strobes are not necessary for PE data.)

Envelope detection is done in parallel with the limiting process. The purpose for this is to disable data output while in the inter-record gap.

The read threshold circuit generates reference levels for the envelope detector. In the write enable mode, the threshold is set for 28 percent of the peak-to-peak read signal amplitude, corresponding to the ANSI definition for tape dropout. In read mode, the threshold is dropped to 15 percent. Selectable lower threshold (TH2) is provided at the 7 percent level. This control line has no effect in write mode.

TANBERG

SECTION V  
PREVENTATIVE MAINTENANCE



## SECTION V

## PREVENTATIVE MAINTENANCE

## 5.1 INTRODUCTION

This section contains procedures for maintaining the equipment in optimum working condition. Corrective maintenance procedures involving disassembly, re-assembly, etc. of the transport are provided in Section VI.

## 5.2 PREVENTATIVE MAINTENANCE SCHEDULE

The TDI 1050 should be cared for on a regular basis as shown in Table 5-1.

TABLE 5.1. PREVENTATIVE MAINTENANCE SCHEDULE

| MAINTENANCE OPERATION                            | FREQUENCY   | PARAGRAPH  |
|--------------------------------------------------|-------------|------------|
| 1. Clean head assembly, tape guides and capstan. | Daily       | 5.3<br>5.4 |
| 2. Clean ceramic tape -leaner.                   | 500 hours   | 5.4        |
| 3. Clean housing and dust cover door.            | As required | 5.5        |

## 5.3 TAPE CLEANER, HEAD ASSEMBLY AND TAPE GUIDE CLEANING

### NOTE

To gain access to the head assembly, tape cleaner and tape guides, lift off the two-part head assembly dust cover.

Clean the components with a lint-free, non-abrasive swab moistened with isopropyl alcohol or head cleaner (Miller-Stephenson MS200 or equivalent). Wipe off excess cleaner and allow components to dry before replacing the dust covers. Clean areas shown in Figure 5-1.

Clean Roller Guides 1 and 2, upper and lower compliance arm guides with a lint-free, non-abrasive wipe or a cotton swab moistened with isopropyl alcohol or head cleaner. (Miller-Stephenson MS200 or equivalent)

### CAUTION

Do not soak the guide with cleaner. Excess solvent may break down the bearing lubricant.

## 5.4 CAPSTAN CLEANING

### CAUTION

DO NOT use alcohol, head cleaner or other solvents to clean capstan sleeve.

Clean the capstan sleeve with a lint-free, non-abrasive wipe moistened with a non-solvent degreaser such as FREON, Type TF.

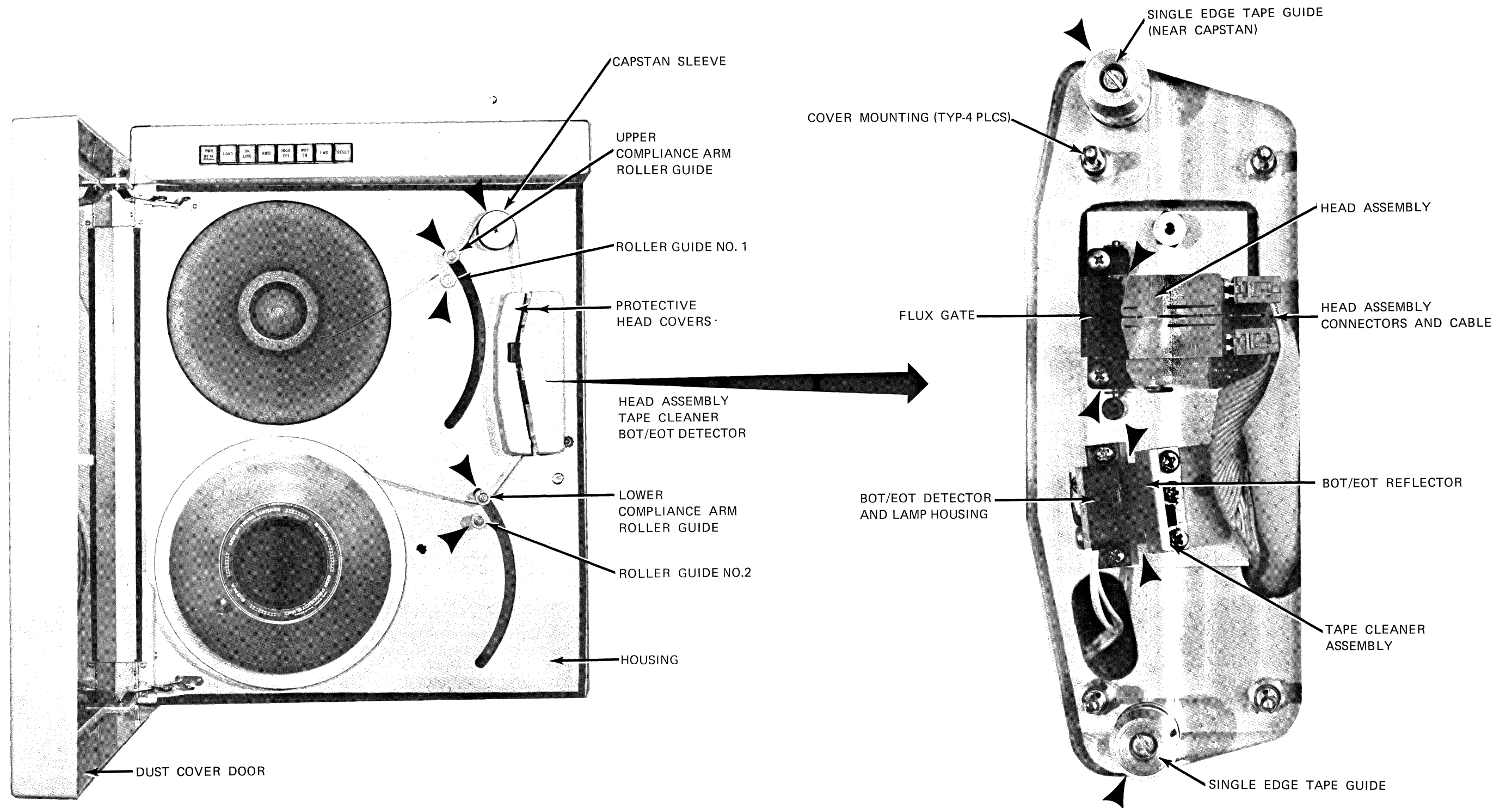


FIGURE 5-1. CLEANING POINTS

## 5.5 HOUSING AND DUST COVER CLEANING

### CAUTION

DO NOT use rough or abrasive material to clean the dust cover door as permanent scratches may result.

Clean the housing, dust cover door, and control panel with Miller-Stephenson MS 260 or equivalent commercial grade cleaner.



**SECTION VI**  
**MAINTENANCE**

## SECTION VI

### MAINTENANCE

#### 6.1 INTRODUCTION

This section contains TDI 1050 Series Tape Transports maintenance and mechanical subassembly replacement procedures. Included are corrective maintenance procedures, recommended tools and test equipment and recommended spare parts. Refer to Section IX for diagrams.

#### CAUTION

These procedures may be performed by trained customer personnel with the express permission of TDI. Alteration or repair of equipment except by TDI personnel or TDI-trained customer personnel will void the Warranty.

#### CAUTION

Equipment rack must be secured if unit is to be swung open. Weight of transport may upset an inadequately balanced equipment rack.

Recommended tools and test equipment are listed in Table 6.1.

TABLE 6.1. RECOMMENDED TOOLS FOR MAINTENANCE

| DESCRIPTION             | P/N                   | SUGGESTED MANUFACTURER |
|-------------------------|-----------------------|------------------------|
| 2.5mm Metrix Hex Driver | LN 2.5mm              | XCELITE                |
| 3mm Metrix Hex Driver   | LN 3mm                | XCELITE                |
| 4mm Metrix Hex Driver   | LN 4mm                | XCELITE                |
| 8mm Metrix Hex Driver   | LN 8mm                | XCELITE                |
| Phillips Screw Drivers  |                       |                        |
| 0 point                 | X100                  | XCELITE                |
| 1 point                 | X101                  | XCELITE                |
| 2 point                 | X102                  | XCELITE                |
| Flat Blade Screwdriver  |                       |                        |
| 5/32" x 4"              | R5324                 | XCELITE                |
| Snap Ring Pliers - Ext. |                       |                        |
| .035 Dia. Tips          | Model 397             | PROTO                  |
| Needle Nose Pliers      | V-16415               | UTICA                  |
| Oscilloscope            | 465                   | TEKTRONIX              |
| VOM                     | 630-NA                | TRIPLETT               |
| Digital Voltmeter       | 4004                  | VALHALLA SCIENTIFIC    |
| Cotton Swabs            |                       |                        |
| Loctite Sealant         | (Red)                 | LOCTITE                |
| Lint Free Cloth         |                       |                        |
| Master Skew Tape        | 432640                | IBM                    |
| Spare Tape              | 3200 FCI<br>Certified | SCOTCH                 |



## 6.2 FUSE REPLACEMENT

There are four fuses used in the TDI 1050. Three eight-ampere (Type AGC-8) are located at zone C-D/18 on the main electronics board. A slo-blo fuse is located in the power input receptacle on the back of the power supply (Refer to Table 2.1 in Section II for the correct fuse selection).

## 6.3 TAPE PATH ALIGNMENT

This procedure is to be used only if a major tape component has been replaced, i.e., roller guides, hubs, capstan sleeve, etc. or a maladjustment of tape path is observed. Figure 6-1 details all of the components of the tape path. To align the path the following procedure is used. If in doubt regarding the method of removal of any part listed see appropriate paragraph in this section.

### Required Tools and Equipment

| <u>Quantity</u> | <u>Description</u>                 |
|-----------------|------------------------------------|
| 1               | IBM Master Skew Tape<br>P/N 432640 |
| 1               | Oscilloscope                       |
| -               | Assorted Hand Tools                |
| -               | Red Loctite                        |
| -               | Spacers (Shims) 0.010 in.          |
| 1               | Micrometer                         |

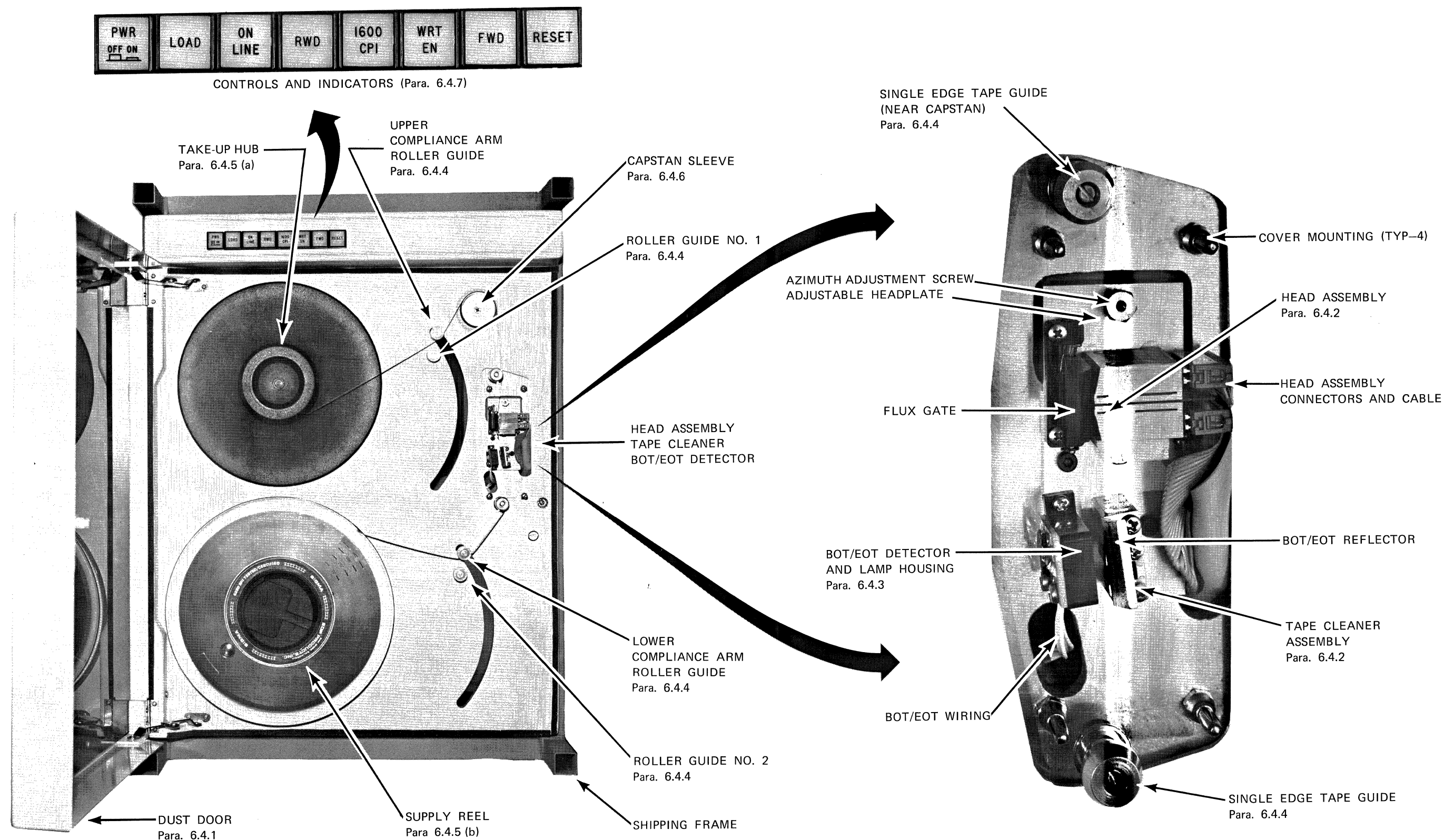
PROCEDURE: Refer to Figure 6-1.

1. Remove protective head covers (2).
2. Remove single-edge tape guide (upper) nearest capstan.
3. Remove roller guides No. 1 and 2.

**NOTE**

Identify locations and save any shims removed for re-assembly.

4. Remove roller guides from upper and lower compliance arms. Save shims.
5. Select a 0.010 inch thick shim and install between lower compliance arm roller guide and the compliance arm. DO NOT use loctite at this time.
6. Select a 0.010 inch thick shim and install between upper compliance arm roller guide and the compliance arm. DO NOT use loctite at this time.
7. Install roller guides No. 1 and 2 using a 0.010 inch thick shim between the guide base and top plate. Secure roller guides lightly, DO NOT use loctite on mounting screws at this time.
8. Mount reel of blank tape, thread transport, and load.
9. Run tape forward and then reverse, adjust reel hub height to center tape on reels. (If required.)
10. Hold single-edge tape guide assembly (upper) in its normal mounting position near the capstan. (See Figure 6-1.) Run tape forward and observe position of tape on capstan sleeve. Stop tape and remove the single-edge tape guide assembly.
11. Run tape forward again - determine if tape position of capstan sleeve moves toward or away from top plate.
  - a. If tape moves away from top plate when tape guide is removed, capstan must be tilted upward.
  - b. If tape moves toward top plate when the guide is removed, capstan must be tilted downward.



## NOTES:

1. FOR ALIGNMENT PROCEDURES SEE PARA. 6.3.
2. FOR REMOVAL AND REPLACEMENT PROCEDURES SEE PARAGRAPH NUMBER LISTED NEXT TO PART.

FIGURE 6-1. TAPE PATH COMPONENTS

## NOTE

Tilt capstan with the two upper adjustment screws on the motor plate.

Adjust tilt until the upper single-edge tape guide can be removed from its normal position without tape shifting on the capstan. Re-install upper single-edge guide tape guide.

12. Run tape forward and observe tape position on capstan sleeve. Repeat observation running tape in reverse.
  - a. If tape moves away from top plate in reverse direction, reduce thickness of shim under roller guide No. 2.
  - b. If tape moves toward top plate in reverse direction, add shims under roller guide No. 2.

When roller guide No. 2 is properly adjusted, tape running position on capstan sleeve will be the same in both forward and reverse directions.

13. Check the tape centering on the crowned compliance arm roller guides. Add or remove shims to center tape path on roller in both forward and reverse directions.
14. Mount master skew tape (IBM P/N 432640). Total skew measured at test point (TP52) must fall within 10% of the byte to byte period listed in Table 6.2 for both forward and reverse directions of tape travel.

### READ/WRITE HEAD AZIMUTH ADJUSTMENT PROCEDURE:

- a. Load 800 bpi master skew tape in accordance with Section III.
- b. Attach oscilloscope to TP52, ground lead to "COM" test point electronics board.
- c. With the transport in the off-line mode (on-line indicator not illuminated), depress forward push button.

TABLE 6.2. READ AMPLIFIER PARAMETERS

| DENSITY<br>(bpi) | SPEED<br>(ips) | DATA<br>RATE<br>(ch/s) | BYTE TO BYTE<br>PERIOD<br>( $\mu$ s) | READ<br>GATE<br>( $\mu$ s) | READ GATE<br>TOLERANCE<br>( $\mu$ s) |
|------------------|----------------|------------------------|--------------------------------------|----------------------------|--------------------------------------|
| 800              | 75             | 60K                    | 16.7                                 | 5.8                        | $\pm 0.06$                           |
|                  | 45             | 36K                    | 13.9                                 | 11.4                       | $\pm 0.1$                            |
|                  | 37.5           | 30K                    | 16.6                                 | 14.1                       | $\pm 0.1$                            |
|                  | 25             | 20K                    | 50                                   | 22.5                       | $\pm 0.2$                            |
|                  | 18.75          | 15K                    | 66.6                                 | 30.8                       | $\pm 0.3$                            |
|                  | 12.5           | 10K                    | 100                                  | 47.5                       | $\pm 0.5$                            |
| 556              | 75             | 41.7K                  | 24.5                                 | 9.7                        | $\pm 0.1$                            |
|                  | 45             | 25K                    | 20                                   | 17.5                       | $\pm 0.2$                            |
|                  | 37.5           | 20.85K                 | 48.7                                 | 21.8                       | $\pm 0.2$                            |
|                  | 25             | 13.9K                  | 72                                   | 33.5                       | $\pm 0.3$                            |
|                  | 18.75          | 10.4K                  | 96.2                                 | 45.6                       | $\pm 0.5$                            |
|                  | 12.5           | 6.95K                  | 143.6                                | 69.3                       | $\pm 0.7$                            |
| 200              | 75             | 15K                    | 66.6                                 | 30.8                       | $\pm 0.3$                            |
|                  | 45             | 9K                     | 55.5                                 | 53.1                       | $\pm 0.5$                            |
|                  | 37.5           | 7.5K                   | 133.3                                | 64.1                       | $\pm 0.6$                            |
|                  | 25             | 5K                     | 200                                  | 97.5                       | $\pm 1.0$                            |
|                  | 18.75          | 3.75K                  | 266.7                                | 130.8                      | $\pm 1.0$                            |
|                  | 12.5           | 2.5K                   | 400                                  | 197.5                      | $\pm 2.0$                            |

- d. Adjust azimuth screw on head mount plate so that output of all tracks, as monitored at TP52, fall within 10% of less byte to byte period listed in Table 6.2. The head azimuth screw works on the differential screw pitch principle. A clockwise rotation of the azimuth screw produces an upward headplate movement. A counterclockwise rotation produces a downward headplate movement.
15. With master skew tape running forward, alternately depress spring-loaded washers on the single-edge tape guides. Skew should increase, but not more than 25% of a byte space.

#### TAPE PATH FORWARD ALIGNMENT PROCEDURE:

- a. If no increase is noted when incoming single-edge tape guide washer is depressed, remove some shims from roller guide No. 1 (nearest supply compliance arm).
  - b. If excess skew is observed when incoming single-edge tape guide washer is depressed, add shims to roller guide No. 1.
  - c. If no skew increase is noted when outgoing guide washer is depressed, capstan motor must be tilted slightly away from guide.
  - d. If excess skew is observed when outgoing guide washer is depressed, tilt capstan motor slightly toward guide.
  - e. The capstan motor plate should be locked in its final position by the adjustment screws pushing and pulling against each other.
16. Run master tape in reverse, and depress washer of single-edge guide nearest capstan. Observe skew. There should be some increase but not more than 25% of byte space.

#### TAPE PATH REVERSE ALIGNMENT PROCEDURE:

- a. If no increase in skew is noted, remove some shims from roller guide No. 2. (See Figure 6-1.)

- b. If excess skew is observed, add shims under roller guide No. 2. (See Figure 6-1.)

17. Secure all mounting screws with red loctite. Take care not to misplace any of the adjustment shims when re-assembling.
18. Run tape in forward and reverse directions. Check rollers and guides for evidence of tape walk, shifting, or edge curl.

#### TAPE PATH DIAGNOSTIC PROCEDURES:

| Failure             | Corrective Action                                                                                           |
|---------------------|-------------------------------------------------------------------------------------------------------------|
| Excessive tape walk | Check compliance arm for squareness.                                                                        |
| Excessive shifting  | Check compliance arm for alignment.                                                                         |
| Excessive edge curl | Single edge guide: excessive spring tension (replace spring)<br>Drum guide undersized (replace drum guide). |

19. Verify that head azimuth is still correct in both forward and reverse directions. Skew must not exceed 10% of a byte space when measured with master skew tape in either direction.
20. Remove scope probes, replace head covers. Secure equipment.

## 6.4 REMOVAL AND REPLACEMENT

Many parts and subassemblies can be removed and replaced using standard tools (Refer to Table 6.1), the procedures outlined herein and the assembly drawings in Section IX. Replacement parts and assemblies should be selected from recommended spare parts kit list Table 6.3 or supplementary spare parts list Table 6.4.

### 6.4.1 Dust Door

The following procedure should be followed in the removal of the dust door:

1. Using a pair of external snap ring pliers, remove the snap rings on the inside of the doors.
2. Remove M3 pan-head phillips screws retaining hinges to the facade assembly.
3. Remove door, and remove striker pin from door leading edge and install replacement.
4. Attach new door to facade assembly. Align door to facade and tighten screws.
5. Assemble snap rings on door retainers.

#### 6.4.2 Read/Write Head Subassembly

The following procedure should be followed in the removal of the head assembly:

1. Open the dust cover, remove upper and lower head covers.

#### CAUTION

Remove connectors carefully to avoid bending pins.

2. Disconnect the two ribbon cable connectors from the head. Identify wires for reassembly and remove the wires on the erase bar (2).
3. Remove the two screws retaining the BOT/EOT sensor and put assembly aside.
4. From the back side of the top plate, remove the M2.5 slotted head screw in the center of the azimuth screw.
5. Remove the three M3 socket head screws and remove the head assembly.



## NOTE

The head assembly is a modular replacement item which is pre-aligned at the factory.

6. Remove the tape threading guides and hardware from the tape cleaner and install on the replacement assembly.
7. Install the new head assembly using the reverse procedure above.
8. Assembly realignment and adjustments are detailed in paragraph 6.3.

### 6.4.3 BOT/EOT Sensor

The BOT/EOT sensor is a modular replacement item. Do not attempt disassembly of sensor subassembly.

1. Remove the two M2.5 pan-head phillips screws that secure the sensor to the head assembly mounting surface.
2. Remove the "P" clip from the backside of the unit and clip the tie-wrap as required to remove cable assembly back to the main electronics board (P/J10).
3. To install, reverse the procedure above.

### 6.4.4 Roller Guides

1. Drum Guides (Refer to Figure 6-1. Roller Guides 1 and 2)
  - a. Remove M3 socket head screws in back with an M2.5 hex driver.

## NOTE

Retain shims on each guide for reassembly.

- b. Install new guide taking care to replace the original shims.
2. Crown Roller Guides (Refer to Figure 6-1. Compliance Arm)
  - a. The crown roller guide is mounted on a post. This is a complete assembly and should be removed and replaced as an assembly.
  - b. Remove retaining hardware and shims from compliance arm guides and replace with new assembly using the original shims.
3. Single-Edge Tape Guides (Refer to Figure 6-1)
  - a. Remove M3 slotted head screw in top of guide to remove guide.
  - b. Install new guide and spring in by attaching M3 screw in plate. Check alignment per paragraph 6.3.

#### 6.4.5 Hubs

To remove or replace the hubs the following procedures should be followed:

1. Take-Up Hub (Upper)
  - a. The take-up hub is accessible from the backside and is retained by a clamp held in place by two M4 socket head screws.

#### **NOTE**

To reach the clamp screws the compliance arms must be down, this is accomplished as follows: Turn power ON, thread the end of a piece of tape through head assembly and depress LOAD. When the arms are down switch power OFF.

- b. Using an M3 socket driver loosen the two M4 socket head screws in the clamp and remove hub.
- c. During replacement, care must be taken to maintain the proper hub position. Thread tape through the path and spool it onto the reel. Adjust the clearance between the hub and the edge of the tape to a gap of 0.050 inch  $\pm 0.015$  inch. Tighten screws uniformly without excessive torque which would deform the hub assembly.

## 2. Supply Hub (Lower)

To replace the supply hub it is necessary to remove the supply motor assembly to which the hub is attached.

- a. Disconnect wiring to supply motor.
- b. Remove the four M5 cap screws holding the motor mounting plate and back the entire assembly out of the backside of the unit.

### NOTE

Before removing or loosening the supply hub, measure the distance between the motor mounting plate and the back surface of the hub. Record values for reassembly.

- c. Loosen the two M4 cap screws and remove hub.
- d. Install new supply hub on motor assembly. Set hub to proper height (as recorded earlier) and secure the two M4 cap screws.
- e. Reinstall motor assembly and wiring removed previously.

## 6.4.6 Capstan Sleeve

### CAUTION

Extreme care should be exercised when handling the capstan sleeve. Sleeve should be gripped lightly with pressure distributed evenly around the circumference.

1. The sleeve is held in place by an M4 flat-head phillips screw. Hold the capstan sleeve as close to the base of the sleeve as possible, to prevent distorting the sleeve. Remove screw.

### NOTE

Retain height adjustment shims located between the inner race front bearings and the capstan sleeve for reassembly.

2. When replacing sleeve, care should be exercised to replace the height adjustment shims.
3. Installation is reverse of removal.

## 6.4.7 Front Panel Switches

The switch assembly removal is performed from the rear of the unit.

1. Open unit to expose backside of top plate.

### NOTE

DISCONNECT POWER CORD.

2. Remove grill on top of power supply. Retain the four M4 phillips, split lockwashers and flat washers for reassembly.
3. Remove the three-pin connector (J26) from the power supply.
4. Disconnect the edge connector from the switch assembly.
5. Remove the two M3 socket head screws securing the switch assembly. Remove switch assembly.
6. Reverse the above procedure for reassembly.

#### 6.4.8 Take-Up Motor (Upper) (Refer to Figure 6-2)

1. Remove hub (See Paragraph 6.4.5a).
2. Remove the four M5 socket-head cap screws holding the motor. (Access under hub.)
3. Remove harness assembly by disconnecting "P" clip on the bottom of the power supply and tie-wraps and "P" clip on main electrons board. (P/J-1 motor driver take-up circuit.)
4. To reinstall motor reverse procedure. Align hub per paragraph 6.3.

#### 6.4.9 Supply Motor (Lower) (Refer to Figure 6-2)

The procedure for removal of the motor is part of the supply hub removal procedure (paragraph 6.4.5b). Follow procedure outlined in paragraph 6.4.5b plus the following:

1. Remove harness assembly to main electronics board (P/J2).
2. Reverse procedure to install new unit.
3. Align per paragraph 6.3.

#### 6.4.10 Capstan Motor

1. Remove capstan sleeve per paragraph 6.4.6.

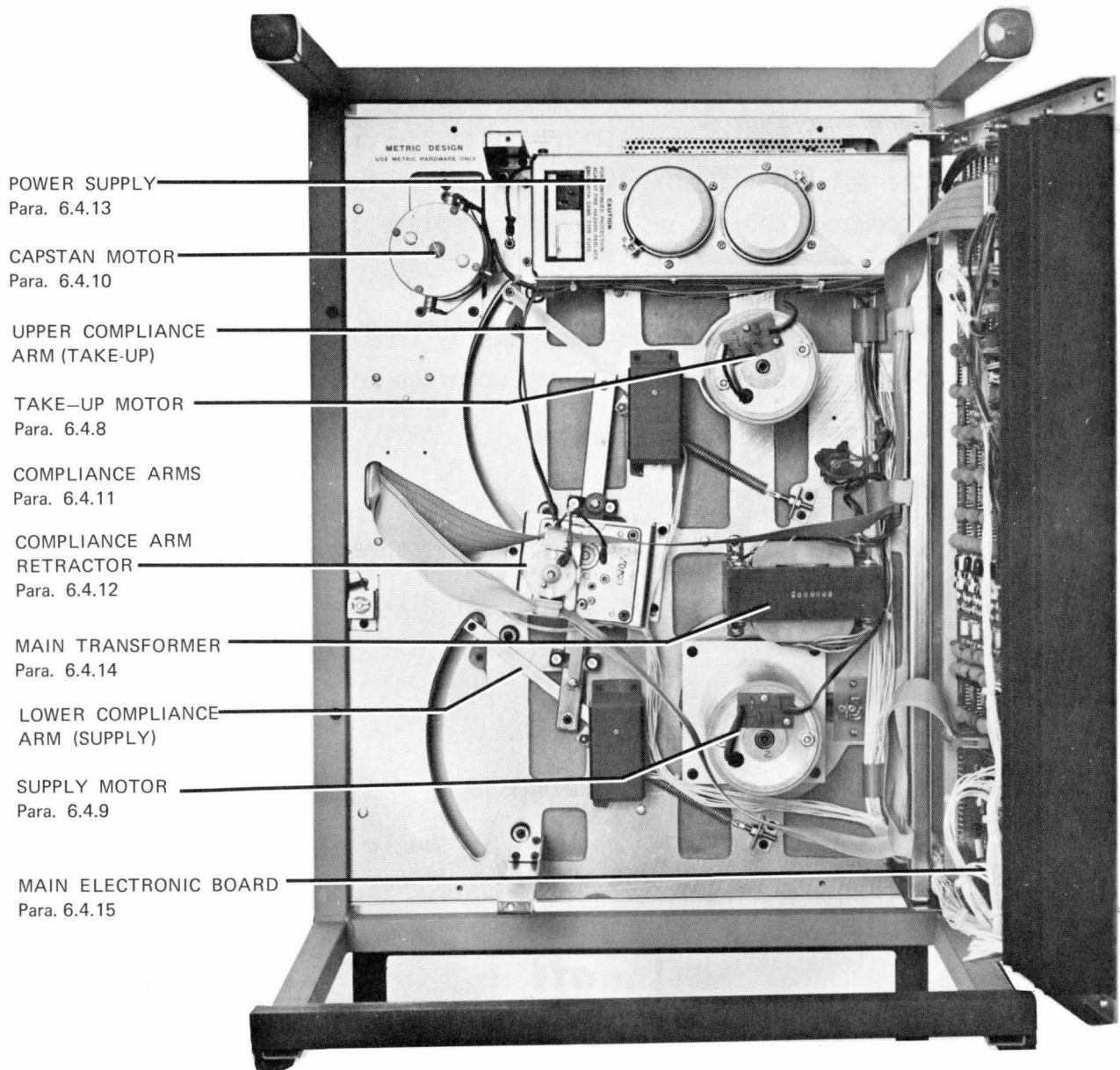


FIGURE 6-2. REAR PANEL LOCATION

## NOTE

Remove shims from shaft and retain for reassembly.

2. There are four cap screws on the mounting plate. The upper two are tilt adjustment screws which effect the mechanical alignment of the drive. The tilt adjustment screw next to the motor must be removed. The bottom two screws are mounting screws which must be removed to replace the assembly.
3. Disconnect wiring from motor.
4. Remove motor from mounting plate by removing four-M4 socket head cap screws. Install new motor on mounting plate.
5. Reinstall mounting plate.
6. Connect wiring.
7. Install capstan sleeve and shims per paragraph 6.4.6.
8. Motor assembly must be aligned per alignment procedure in paragraph 6.3, Tape Path Alignment.

### 6.4.11 Compliance Arms (Refer to Figure 6-2)

1. Upper Compliance Arm (Take-up)
  - a. Place retractor assembly in the lower position.
  - b. Remove the crown guide from the end of the shaft.

## NOTE

Retain all hardware and shims for reassembly. Noting location and assembly.

- c. Remove the tension spring.

- d. Remove the three M3 socket head cap screws holding the cap flanges to the back surface.
  - e. Remove assembly.
2. Lower Compliance Arm (Supply) (Refer to Figure 6-2)
- a. Remove the slider bar by sliding it past the reel motor adapter plate.
  - b. Remove the crown guide from the end of the shaft.

## NOTE

Retain and identify all hardware and shims for reassembly, noting location and assembly.

- c. Remove the tension spring.
  - d. Remove the three M3 socket head cap screws holding the cap flanges to the back surface.
  - e. Remove the assembly.
3. Installing Compliance Arms (Refer to Figure 6-2)
- a. Install tension spring.
  - b. Attach the three M3 base mounting screws.
  - c. Reinstall roller guides with shims.

## NOTE

A Tape Path Alignment must be performed after replacement of these parts, see paragraph 6.3.



## 6.4.12 Compliance Arm Retractor (Refer to Figure 6-2)

The compliance arm retractor assembly is a modular replacement. Do not attempt to disassemble the unit except as outlined within this procedure.

1. Disconnect electrical quick disconnect clips on the motor terminals, open cable clamps, remove the read and write flat ribbon cables.
2. Remove the M4 pan-head phillips connecting the end of the cast crank arm to the connecting link.
3. Unharness the cable assembly.
4. Remove the four M4 mounting screws. Pull assembly back and remove retractor board assembly from inside of bracket.
5. Reinstall retractor board assembly in bracket assembly.
6. Remove black shutter top from the cast arm (remove M3 pan-head phillips) and reinstall on new cast arm.

### CAUTION

Care must be taken so that the shutter will sweep freely through the two black optical switch assemblies.

7. Remount on top plate with original mounting screws.
8. Reconnect connecting link to cast crank arm.
9. Reinstall quick disconnects, reroute head cables.

## 6.4.13 Power Supply (Refer to Figure 6-2)

The power supply assembly is removed as a complete unit by using the following procedure:

1. Remove power cord.

2. Remove ground wire to left of unit.
3. Remove top cover, disconnect connectors for power switch, PCB and transformer, remove harness from power switch and the PC board from the unit. Remove harness from the unit.
4. Remove the four M4 socket head screws on the flanges holding the unit.
5. Remove the unit.
6. Reverse procedure to install unit.

#### 6.4.14 Main Transformer (Refer to Figure 6-2)

1. Remove power supply cover and remove cable connectors to transformer.
2. Disconnect cable from harness (clip tie-wraps).
3. Remove four M4 socket head cap screws.
4. Remove and identify quick disconnect clips to the diode bridge for proper placement.
5. Remove transformer.
6. Reverse procedure to install.

#### 6.4.15 Main Electronic Board (Refer to Figure 6-3)

The main electronics board is removed as an assembly by the following procedure:

1. Remove all connectors.
2. Remove tie-wraps and "P" clips.
3. Remove the upper and lower M4 pan-head phillips hinge pin screws. Retain teflon washers.
4. Reverse procedure to install.

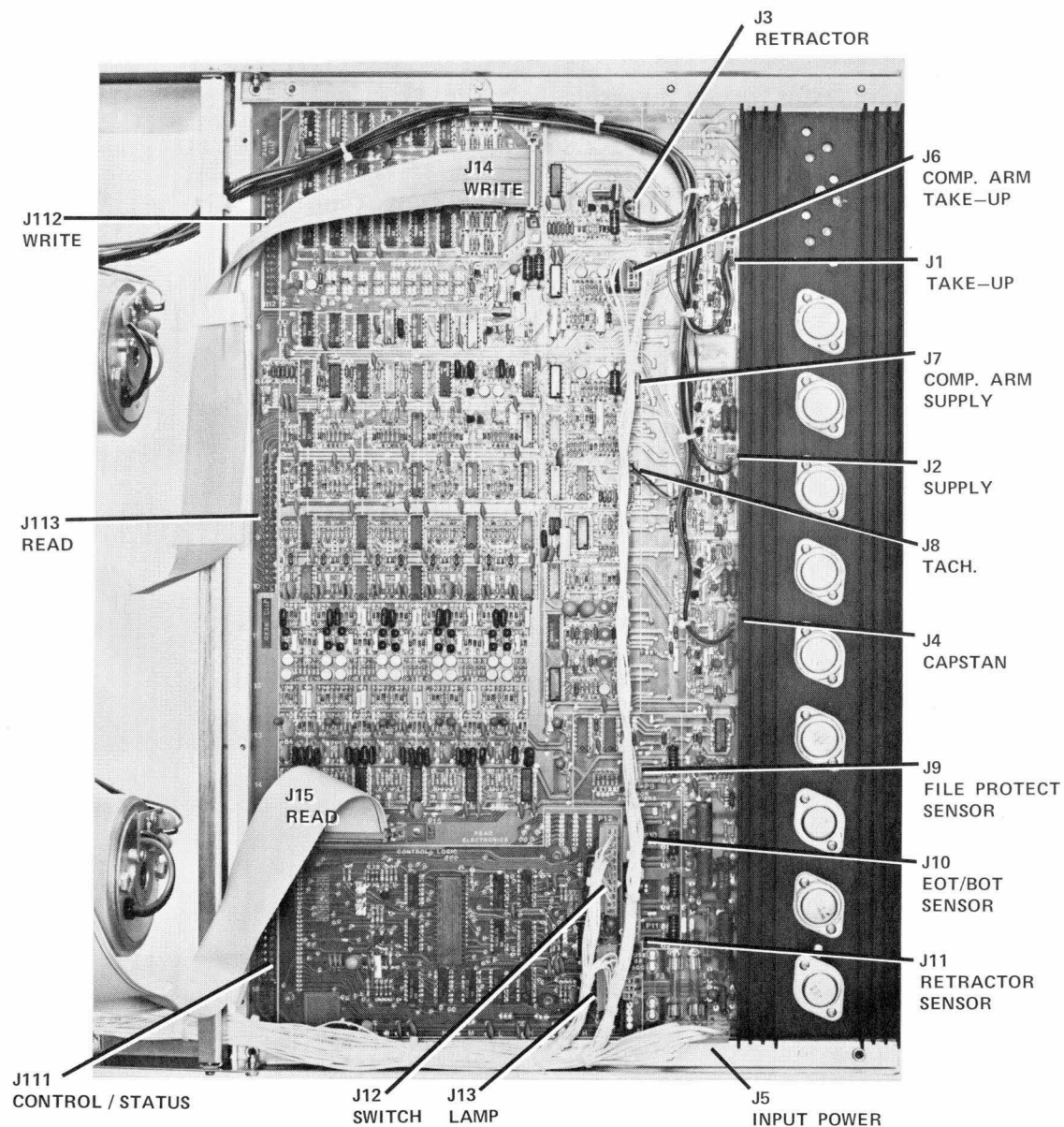


FIGURE 6-3. MAIN ELECTRONIC BOARD

TABLE 6.3. RECOMMENDED SPARE PARTS KIT (1.)

| TDI P/N       | DESCRIPTION                                        | QUANTITY |
|---------------|----------------------------------------------------|----------|
| 11-0003       | I/O Interface PCB Assembly<br>(Standard Interface) | 1        |
| 11-00025      | I/O Interface PCB Assembly<br>(W/Formatter Option) | 1        |
| 11-00075      | Main Electronics Board, Standard                   | 1        |
| 11-00035      | Main Electronics Board, W/Formatter                | 1        |
| 11-10055      | Power Supply Assembly, Standard                    | 1        |
| 11-10034      | Power Supply Assembly, W/Formatter<br>Option       | 1        |
| 11-00028      | EOT/BOT Sensor Assembly                            | 1        |
| 11-00029      | File Protect Sensor Assembly                       | 1        |
| 24-10001      | Lamp, GE682, EOT/BOT                               | 2        |
| 24-10003      | Lamp, GE 7332, Compliance Arm Assembly             | 2        |
| 24-10004      | Lamp, GE73, Switch Assembly                        | 5        |
| 24-40007 (2.) | Fuse, 8 amp, (AGC-8)                               | 5        |
| 24-40012      | Fuse, 6 $\frac{1}{4}$ amp, (3AG-SB)                | 5        |
| 49-00004      | Rectifier, MDA 980-1                               | 1        |

Note:

1. Recommended parts quantity will support up to four operating trans-ports.
2. Refer to Table 2.1 for applicable voltage ratings.

TABLE 6.4. SUPPLEMENTARY SPARE PARTS LIST (1.)

| TDI P/N  | DESCRIPTION                              |
|----------|------------------------------------------|
| 11-00026 | Retractor Motor Sensor Assembly          |
| 11-00032 | Control Panel Assembly                   |
| 11-10030 | Roller Guide Assembly, Top Plate (Fixed) |
| 11-10031 | Roller Guide Assembly, Compliance Arm    |
| 11-10037 | Reel Motor Assembly, Take-up             |
| 11-10038 | Facade                                   |
| 11-10039 | Dust Door                                |
| 11-10040 | Compliance Arm Assembly                  |
| 11-10041 | Head Plate Assembly, 9-track             |
| 11-10043 | Retractor Motor Assembly                 |
| 11-10045 | Capstan Motor Assembly                   |
| 11-10046 | Reel Hub Assembly, Supply                |
| 11-10047 | Reel Motor Assembly, Supply              |
| 11-10048 | Reel Hub Assembly, Take-up               |
| 12-30002 | Cable Assembly, Read Head                |
| 12-30003 | Cable Assembly, Write Head               |
| 12-30006 | Cable Assembly, Control Panel            |
| 12-40001 | Transformer Assembly, Standard           |
| 12-40003 | Transformer Assembly, w/Formatter Option |
| 14-00096 | Guide Cover                              |
| 14-00097 | Head Cover                               |
| 14-10011 | Capstan Sleeve                           |

Note:

1. Available directly from TDI.

TANDBERG

SECTION VII  
TESTING

## SECTION VII

### TESTING

Off-line diagnostic tests are provided with the TDI 1050. These tests are integrated into the F8 control program. Individual tests are selected through a combination of test and option jumpers located on the Main Electronics Board and the front panel control switches.

The purpose of the diagnostic tests is to facilitate equipment maintenance and fault isolation testing in the field without special test equipment. In many cases, the failure may be isolated to a component or replaceable assembly which may be repaired on-site. Other applications involve acquiring failure symptoms data which aid field service procedures and minimize system down-time. The procedures given in this section should only be performed by qualified personnel with the consent of Tandberg Data, Inc.

#### 7.1 GENERAL

The TDI 1050 self-test feature is contained in the transport F8 processor control program. The self-test feature is designed for OFF-LINE operation only, i.e. the transport is disconnected from the operational system.

Preparatory to selecting the appropriate test, the failure symptoms should be reviewed. Table 7.1 shows the test grouped into three sets:

1. Basic Transport Adjustments - Essential tape control parameter involving servo operation.
2. Repetitive Transport Exercises - Involving cyclic operation of all servos, with all self-protective features activated.

TABLE 7.1. SELF-TEST SELECTION

| GROUP | TEST                                                                                                                                                                                                                          |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | <u>BASIC TRANSPORT ADJUSTMENTS</u><br>A. Setting the capstan speed - Forward and Reverse.<br>B. Setting capstan servo ramp time - FWD and REV.<br>C. Setting READ channel gains - NRZI and PE mode, ramp time and write skew. |
| 2     | <u>REPETITIVE TRANSPORT EXERCISES</u><br>A. Forward motion - start/stop cycle.<br>B. Reverse motion - start/stop cycle.<br>C. Retractor motor/servo - start/stop cycle.<br>D. Rewind cycle.<br>E. Test loop cycle.            |
| 3     | <u>OPERATIONAL PASS/FAIL TEST</u><br>A. Unload limit test.<br>B. NRZI Write/Read data test.<br>C. P.E. Write/Read data test.<br>D. Servo limit test.                                                                          |

- Operational Pass/Fail Test - Where specific pass/fail criteria are applied to servo tests and to data transfer and recovery from tape.



The order of performing these tests would normally begin with Group 1 and end with Group 3. However, experience and knowledge of the particular failure symptoms may indicate that a specific should be performed first. There is no restriction in the order of performing the diagnostic tests. Shown in Table 7.2 are the recommended test procedures applicable to general failure symptoms.

TABLE 7.2. DIAGNOSTIC-TESTS SELECTION

| PROBLEM         | FUNCTION AFFECTED      | TEST SEQUENCE         |
|-----------------|------------------------|-----------------------|
| Data Errors     | Read/Write electronics | Group 3, Tests B or C |
| Parity Error    |                        | Group 1, All Tests    |
| Corrected Error |                        | Group 2, All Tests    |
| Servo Control   | Reel Servos            | Group 3, Tests A & D  |
|                 | Capstan Servo          | Group 2, All Tests    |
|                 |                        | Group 1, Test A & B   |

Refer to Section VII, Troubleshooting for fault isolation procedures.

## 7.2 DIAGNOSTIC TEST PROCEDURES

Test routines which are built into the F8 processor control program are activated by a combination of test jumper settings on the Main Electronics Board and operation of front panel switches. Jumpers are designated by the nomenclature E-, which may be located by labels printed on the circuit board. For standard configuration units, the jumpers shown in Table 7.3 should be installed at the beginning and end of the testing. (Optional configurations should be recorded prior to diagnostic testing.)

TABLE 7.3. STANDARD CONFIGURATION JUMPERS INSTALLED

|         |         |
|---------|---------|
| E4-E5   | E34-E35 |
| E10-E12 | E21-E22 |
| E13-E14 | E26-E27 |
| E16-E17 | E2-E3   |
| E28-E29 | E39-E40 |

Access to the jumper requires removal of two screws at the left top and bottom corners on the Main Electronic Board. The printed circuit board hinges open. During testing, assure that the circuits do not contact the mounting rack metal supports and cause electrical short circuiting.

Verify that the jumpers listed in Table 7.3 are installed, then perform the following procedure to enter the test mode:

#### 7.2.1 Test Mode Set-Up

1. On the Main Electronic Board Zone H-17 move  
E10 - E12 to E10 - E11  
E39 - E40 to E43 - E44
2. On the transport, mount a spare reel of tape.
3. On the front panel, depress LOAD.
  - a. Normal load sequence will occur and the tape will stop at the beginning of tape (BOT).
  - b. The RESET switch/indicator will illuminate, indicating that the self-test program is operating. During any test, depressing RESET is a normal exit from the test in progress which permits selection of the same or alternate tests.

To select the Test Group, move the jumper for the desired test group shown in Table 7.4. Test sequences which attempt to write

TABLE 7.4. DIAGNOSTIC TEST CONTROLS

| TEST GROUP 1                         |  | LOAD<br><br>&<br><br>FWD             | ON LINE<br><br>&<br><br>FWD                 | REW                               | 1600 CPI<br><br>& ON LINE<br><br>& FWD          | WRT EN                                         | FWD                                          | RESET            |
|--------------------------------------|--|--------------------------------------|---------------------------------------------|-----------------------------------|-------------------------------------------------|------------------------------------------------|----------------------------------------------|------------------|
| SWITCHES                             |  |                                      |                                             |                                   |                                                 |                                                |                                              |                  |
| JUMPERS                              |  |                                      |                                             |                                   |                                                 |                                                |                                              |                  |
| E16 - E17<br><br>to<br><br>E16 - E18 |  | START/<br><br>STOP<br><br>FORWARD    | NRZI WRITE<br><br>@ 15 ms/<br><br>CHARACTER | REWIND<br><br>NORMAL              | PE WRITE<br><br>@ 15 ms/<br><br>CHARACTER       | REVERSE<br><br>NORMAL<br><br>SPEED             | FORWARD<br><br>NORMAL<br><br>SPEED           | STOP<br><br>TEST |
| TEST GROUP 2                         |  | LOAD                                 | ON LINE                                     | REW                               | 1600<br>CPI<br><br>LOAD                         | WRT EN                                         | FWD                                          | RESET            |
| SWITCHES                             |  |                                      |                                             |                                   |                                                 |                                                |                                              |                  |
| JUMPERS                              |  |                                      |                                             |                                   |                                                 |                                                |                                              |                  |
| E13 - E14<br><br>to<br><br>E13 - E15 |  | FORWARD/<br><br>REVERSE<br><br>CYCLE | REWIND<br><br>TEST<br><br>CYCLE             | REWIND<br><br>NORMAL              | (Unload Tape)<br><br>LOAD SW =<br><br>SERVO TST | REVERSE<br><br>START/<br>STOP<br><br>(0.5 sec) | FORWARD<br><br>START/<br>STOP<br><br>(1 sec) | STOP<br><br>TEST |
| TEST GROUP 3                         |  | LOAD                                 | ON LINE                                     | REW                               | 1600 CPI                                        | WRT EN                                         | FWD                                          | RESET            |
| SWITCHES                             |  |                                      |                                             |                                   |                                                 |                                                |                                              |                  |
| JUMPERS                              |  |                                      |                                             |                                   |                                                 |                                                |                                              |                  |
| E4 - E5<br><br>to<br><br>E4 - E6     |  | SERVO<br><br>STABILITY<br><br>CYCLE  | (NONE)                                      | REWIND<br><br>NORMAL<br><br>CYCLE | PE<br><br>READ/WRITE<br><br>CYCLE               | NRZI<br><br>READ/<br>WRITE<br><br>CYCLE        | UNLOAD<br><br>TEST<br><br>CYCLE              | STOP<br><br>TEST |

Note: Replace Jumpers When Test Group Series Is Completed.

data, require jumper E39-E40 to E43-E44 (zone V-4 in the Write Electronics portion of the Main Electronics Board). The controls and indicators of the TDI 1050 take on new functions defined in Table 7.4 during test operations.

## 7.2.2 Test Group One - Basic Transport Adjustments

### OBJECTIVES

- Set Capstan speed - forward and reverse
- Set capstan servo ramp time - forward and reverse.
- Set READ channel gains - NRZI and P.E. modes.

### JUMPERS

E16 - E17 to E16 - E18 (Zone H/J-17)

### CONTROLS

FWD, LOAD: Start/Stop motion in forward direction.

FWD, ON LINE: Write NRZI one character approximately every 15.8ms (forward motion) and check for a level of 11V peak to peak (at 45 ips) while monitoring each read amplifier input test point. Adjust R335 through R343 respectively for each channel.

### **NOTE**

Jumper E39 - E40 MUST be moved to E43 - E44 to perform WRITE operations while in the Test Mode.

RWD: Normal rewind/unload function.

FWD, ON LINE  
1600 CPI: Writes one burst every 15 ms in P.E. mode. Check for 17V peak to peak signal (at 45 ips) while

monitoring each read amplifier input test point. Adjust R326 through R334 respectively for each channel.

WRT EN: Move tape in reverse at normal speed.  
WRT EN, LOAD: Start/Stop motion in reverse direction.  
FWD: Move tape forward at normal speed.  
RESET: Normal abort function.

Upon completion of Group One tests return Jumper E16 - E18 to the E16 - E17 (Normal) position.

### 7.2.3 Test Group Two - Repetitive Transport Exercises

#### OBJECTIVES

- Forward motion start/stop cycle.
- Reverse motion start/stop cycle.
- Retractor motor and servo start/stop cycle.
- Rewind cycle.
- Test Loop Cycle.

#### JUMPERS

E13 - E14 to E13 - E15 (Zone H/J-17)

#### CONTROLS

LOAD: Test Loop Cycle.  
Tape will move one second forward, half-second reverse until EOT is sensed; then one second reverse, half-second forward until BOT is sensed, at which time, the forward for one second, reverse for half-second operation is repeated. When EOT is sensed, the tape is rewound to load point. When Load Point is sensed, test loop repeats.

|           |                                                                                                                                                                                                                               |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ON LINE:  | Rewind Test Cycle. The tape will run forward for 10 seconds, then rewind. When load point is sensed, the test resumes. The 1600 CPI indicator will blink during forward motion.                                               |
| REW:      | Normal rewind sequence.                                                                                                                                                                                                       |
| 1600 CPI: | Unloads tape and disables servo amplifiers. Dismount tape reel and press LOAD switch to exercise retractor motor and all servos. To exit this test sequence, depress RESET and remount tape.                                  |
| WRT EN:   | Start/stop reverse operation at 0.5 second interval until BOT is sensed, at which time, tape runs forward to EOT, and the start/stop motion resumes. The 1600 CPI indicator will blink, indicating test sequence in progress. |
| FWD:      | Start/stop forward motion at one second intervals until EOT is sensed, at which time the tape will rewind and the start/stop motion will resume. The 1600 CPI indicator will blink, indicating test sequence is in progress.  |
| RESET:    | Normal abort function.                                                                                                                                                                                                        |

Upon completion of Group Two test return jumper E13 - E15 to the E13 - E14 (Normal) position.

#### 7.2.4 Test Group Three - Operational Pass/Fail Test

##### OBJECTIVES

- Unload limit test.
- NRZI Write/Read data test.
- P.E. Write/Read data test.
- Servo limit test.

## JUMPERS

E04 - E05 to E04 - E04 - E06 (Zone J/H-17)

E39 - E40 to E43 - E44 - E44 (Zone V-4)

## CONTROLS

### **NOTE**

Before each sequence listed below rewind tape to load point - then press appropriate switch for desired test operation.

#### LOAD:

Servo Test.

Tape runs forward for five seconds, then a decreasing period forward/reverse oscillation is maintained until the interval becomes zero; at which time, the tape runs forward to EOT, then reverses for five seconds. The same forward/reverse motion then repeats, terminating when the interval again becomes zero. If the arm limit remains FALSE during the test, WRT EN remains illuminated and the test cycles. If arm limit becomes TRUE during the test, the test is aborted and the RESET lamp will flash.

#### ON LINE:

Not used in this test sequence.

#### REW:

Normal rewind operation.

#### 1600 CPI:

Phase Encoded Read/Write Test.

Flux reversals are recorded in PE mode beginning at BOT. Tape is then rewound and read forward, looking for flux reversals for a short period. If flux reversals are seen, WRT EN remains illuminated. If reversals are not detected, the test is aborted and RESET indicator will flash.

WRT EN: NRZI Read/Write Test.  
Same as P.E. Test above, but in NRZI mode.

FWD: Unload Limit Test.  
Tape will begin unloading if at load point. If arm limit status remains FALSE for one second, unload will cease and WRT EN will be illuminated. If arm limit becomes TRUE during the unload test, motion will cease and RESET will flash, indicating the test has failed.

RESET: Normal abort function.

Upon completion of use of the self-test feature return all jumpers to the normal position.

E43 - E44 to E39 - E40; E10 - E12 to E10 - E11.

If all tests have been successfully completed and the tape transport is operational, return to system.

## 7.3 OPERATIONAL TESTS

### 7.3.1 Voltage Checks

With power ON check the following voltages at test points on main electronics board.

- A.  $\pm 20$  volts = 23 to 27 volts with approximately 400 MV of ripple at 120 Hz.
- B. +5 volts = +5V, adjust R66 if necessary.
- C.  $\pm 15$  volts = 14.25 to 15.75 volts.
- D.  $\pm R$  = Approximately equal to each other and between 8.7 and 9.5V.

### 7.3.2 Sensor Checks

#### A. Lamp Out

1. TP 61, Lamp out (L) is FALSE, 13H pin 5 = +2.9V



2. Disconnect J11
3. TP 61, Lamp out (L) is TRUE, 13H pin 5 = 0V
4. Connect J11

## B. Retractor Motor Sensors

1. With system power ON, and no tape in path, adjust arms for 1/32 inch clearance from top stop.
2. RUP (L) is TRUE. (13F pin 1)
3. Thread tape, depress LOAD switch. Upon completion of load sequence, RDN (L) is TRUE. (13F pin 2)

## C. EOT/BOT

1. With no tape in path
  - a. ETS is TRUE.
  - b. BOT is TRUE.
  - c. 13F pin 8 =  $\leq +0.8V$
  - d. 13F pin 10 =  $\leq 0.8V$
2. Tape without Marker in Path
  - a. ETS is FALSE (13F pin 13)
  - b. BOT is FALSE (13F pin 14)
  - c. 13F pin 8 = +4V
  - d. 13F pin 10 = +4V
3. Tape with BOT Marker in Path
  - a. ETS is FALSE (BOT is outer sensor)
  - b. BOT is TRUE (13F pin 8 =  $\leq 1V$ )
4. Tape with EOT Marker in Path
  - a. ETS is TRUE (13F pin 10 =  $\leq 1V$ )
  - b. BOT is FALSE

## D. Ring

1. Ring normal = 13H pin 7 = +4V (RING (L) is FALSE).
2. Ring depressed = 13H pin 7 =  $\leq 0.8V$  (RING (L) is TRUE).

### 7.3.3 Take-Up Arm Adjustments

Perform the following steps with system power ON, no tape in path and arms down.

- A. Monitor J6 pin 2 with a DVM (negative voltage).
- B. Monitor TP3 with oscilloscope.
- C. Move arm through entire range. Note the voltage swings to approximately +10V and -10V from upper reference mark to lower reference mark. Sensor shutter position determined swings equality.
- D. Move arm to center reference mark ( $\pm 3/8$  inch), the DVM should indicate 0V. The oscilloscope should indicate a zero voltage when the DVM is at 0V, if not adjust R77 (Zone F4) to achieve 0V reading.

### 7.3.4 Supply Arm Adjustments

Perform the following steps with system power ON, no tape in path and arms down.

- A. Monitor J7 pin 2 with a DVM (negative voltage).
- B. Monitor TP4 with oscilloscope.
- C. Move arm through entire range. Note the voltage swings to approximately +10V and -10V from upper reference mark to lower reference mark.
- D. Move arm to center reference mark ( $\pm 3/8$  inch), the DVM should indicate 0 volts. The oscilloscope should indicate a zero voltage when the DVM is at 0 volts, if not adjust R97 (Zone F6) to achieve 0V reading.

## 7.3.5 Arm Limit Adjustments

### A. Take-Up

1. Position supply arm securely in operating area.
2. Monitor TP60 with oscilloscope.
3. With take-up arm resting on lower stop, adjust R85 (Zone H4) in a clockwise direction for a 0V reading at TP60.
4. Lift take-up arm so lower edge coincides with lower reference mark. TP60 should read +5V at this point, if not, adjust R85 counter clockwise. Recheck step 3.
5. Move take-up arm past upper reference point. TP60 shall return to 0V at a point between the upper reference point and upper stop. R77 (Zone F4) may require a slight readjustment to realize the proper relationship.
6. Release supply arm.

### B. Supply

1. Position take-up arm securely in operating area.
2. Monitor TP60 with oscilloscope.
3. With supply arm resting on lower stop, adjust R105 (Zone H6) in a clockwise direction for a 0V reading at TP60.
4. Lift supply arm so lower edge coincides with lower reference mark. TP69 should read +5V at this point, if not, adjust R105 counter clockwise. Recheck step 3.
5. Move supply arm past upper reference point. TP60 shall return to 0V at a point between the upper reference point and upper stop. R97 (Zone F6) may require a slight readjustment to realize the proper relationship.
6. Release take-up arm.

## 7.3.6 Operational Checks

The following operational checks shall be performed with the power ON, tape loaded, and appropriate test jumpers in place. Refer to paragraph 7.2 for self-test features.

### A. Capstan RPM

1. With oscilloscope, monitor the collector of the capstan driver, transistor 12A. Adjust R28 for 0 volts reading on the oscilloscope.
2. Observe that capstan motor is not drifting.
3. Monitor the capstan tachometer at TP-1 with oscilloscope. Enter test group one, Forward Normal Speed test (ref. 7.2.2). Adjust R6 for a +1.3V reading at TP-1.
4. Enter test group one, Reverse Normal Speed test (ref. 7.2.2). Adjust R15 for a -1.3V reading at TP-1.

### B. NRZI Read Test

1. With oscilloscope monitor TP-6.
2. Enter NRZI Read/Write Cycle (ref. 7.2.4).
3. Adjust R335 for 5.5V peak signal at TP-6.
4. Repeat operation for each channel.
5. With oscilloscope, monitor TP-52. Adjust R496 and R498 for read gate equal to 13.9 $\mu$  sec. for low going excursion of signal.

### C. P.E. Read Test

1. With oscilloscope, monitor TP-6.
2. Enter P.E. Read/Write Cycle (ref. 7.2.4).
3. Adjust R326 for 8.5 volts peak at TP-6.
4. Repeat operation for each channel.

### D. Fine Speed Adjustment

1. Enter NRZI Write Test (ref. 7.2.2).

2. With oscilloscope, Channel 1, monitor E-39, Test Write Strobe (TWS).
3. With oscilloscope, Channel 2, monitor TP-6.
4. Adjust R6 for time between leading edge of test write storbe (TWS) and leading edge of read signal equal to 3.34 milliseconds.
5. Record the time between succeeding read signals (synchronize oscilloscope on Channel 2).
6. Enter Reverse Normal test. Adjust R15 for time between read signals equal to time measured in Step 5.

#### E. Ramp Adjustment

1. With oscilloscope, monitor TP-1. Synchronize scope on FWD command available at IC 11J pin 14.
2. Adjust R22 for ramp time of 6.7 milliseconds at 80% of ramp voltage.
3. Determine that stop ramp and reverse start and stop ramps are approximately similar.

#### F. Securing from test

Remove test jumpers per 7.2. Return unit to operational configuration. Ensure that all jumpers tested in Table 7.4 are in normal position.



## SECTION VIII TROUBLESHOOTING

## SECTION VIII

### TROUBLESHOOTING

#### 8.1 INTRODUCTION

This section contains instructions for determining the cause of the more common tape transport malfunctions. If a malfunction occurs which cannot be isolated with these instructions, use standard troubleshooting procedures in conjunction with the built-in diagnostic test program.

#### **NOTE**

Before performing any troubleshooting, check to see that the equipment is connected properly and that all associated equipment is in good operating condition.

In order to locate a malfunction, the troubleshooter should establish a logical approach to the problem. It is important that he follows instructions and understands the theory of operation and built-in diagnostic test program.

One of the first approaches to locating the malfunction should be to visually inspect the unit for damaged components. Many times mechanical malfunctions can be isolated by listening for unusual noises while the transport is operating. When a defective component is located, identify it by referring to Section IX to get the part number and/or its value. If a replacement part is available, substitute it for the suspected defective part.



## NOTE

If replacement of the defective component requires major alignment, it is recommended that the unit be returned to TDI for factory repair and adjustment.

### 8.2 COMMON PROBLEMS

Table 8.1 lists the common problems associated with tape transport operation, together with the probable cause and remedy.

### 8.3 SYSTEM TROUBLESHOOTING

Table 8.2, used in conjunction with the schematic diagrams in Section IX provides an aid to the isolation and repair of faults.

### 8.4 TROUBLESHOOTING WITH OFF-LINE DIAGNOSTIC TESTS

The TDI 1050 troubleshooting philosophy is one of isolation and repair. The troubleshooting chart in Table 8.3 will help identify the more complex problems. When used in conjunction with the off-line diagnostic tests, isolation of the failure should be possible in most cases to single component or circuit. Table 8.3 has been developed to show the common failures in order of frequency of occurrence.

### 8.5 TEST POINT CHARTS

Table 8.4 contains a listing of the TDI 1050 test points, board location and signal descriptions.

### 8.6 CIRCUIT BOARD ADJUSTMENTS

Table 8.5 contains a listing of the main electronic board adjustment points.

TABLE 8.1. COMMON PROBLEMS

| TROUBLE                                                | PROBABLE CAUSE                                                   | REMEDY                                                                |
|--------------------------------------------------------|------------------------------------------------------------------|-----------------------------------------------------------------------|
| Reel flanges scrape tape                               | Reels improperly mounted                                         | Reinstall reel evenly. (See Section III)                              |
| BOT and EOT markers not sensed                         | Dirt covering reflective strip or sensor                         | Clean sensor or reflective strip                                      |
| Reels continue to rotate after tape leaves photosensor | Upper or Lower compliance arm limits out of adjustment or faulty | Readjust or replace                                                   |
| Tape fails to pull properly through machine or spills  | Improper tape threading                                          | Rethread tape. (See Section III)                                      |
| Excessive data dropout                                 | Dirt on head or damaged tape                                     | Clean head (See Section V) and/or install new certified computer tape |
| Transport will not function at all                     | Defective fuse                                                   | Replace fuse                                                          |
| POWER switchlight does not illuminate                  | No primary power                                                 | Check for primary power                                               |
|                                                        | Defective indicator lamp                                         | Replace control/indicator                                             |

TABLE 8.1. COMMON PROBLEMS (CONTINUED)

| TROUBLE                                                | PROBABLE CAUSE                            | REMEDY                                                                                                                                  |
|--------------------------------------------------------|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Machine does not accept commands                       | Improper interface                        | Check interface and correct as necessary                                                                                                |
|                                                        | More than one command true simultaneously | Enable only desired command - hold other inputs high                                                                                    |
|                                                        | No BOT Marker on tape                     | Affix marker to tape approximately 12 ft. from the physical beginning of tape. Place marker near reference edge on backing side of tape |
| Tape tensioned but does not advance when capstan turns | Tape not threaded over capstan            | Rethread tape (See Section III)                                                                                                         |
| Tape tensioned but slips                               | Dirty capstan                             | Clean capstan in accordance with Section V                                                                                              |
| Tape moves during a stop condition                     | Motor voltage not zero                    | Check capstan servo and adjust for zero offset                                                                                          |
|                                                        |                                           | Replace capstan assembly and re-align servo                                                                                             |

TABLE 8.1. COMMON PROBLEMS (CONTINUED)

| TROUBLE                                                      | PROBABLE CAUSE                                   | REMEDY                                                                                                             |
|--------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| Tape not tensioned or tape is spilled when ready mode is set | Improper tape threading                          | See Section III                                                                                                    |
|                                                              | Reel servo or motor malfunctioning               | Repair reel servo<br>Replace motor                                                                                 |
| Transport responds to write commands but tape is not written | Write current not enabled                        | Check for write enable ring on reel. Check write current command path to tape head. Check that read is not enabled |
| Computer does not read tapes correctly                       | Data format incorrect                            | Use correct format                                                                                                 |
|                                                              | Record length exceeds computer memory capability | Use correct record length                                                                                          |

TABLE 8.2. SYSTEM TROUBLESHOOTING

| TROUBLE                                                                                       | PROBABLE CAUSE                                           | REMEDY                                                                      |
|-----------------------------------------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------------------------------------------|
| Tape does not tension and the capstan shaft rotates freely when the LOAD control is depressed | LOAD control is not operative                            | Check operation of LOAD control. Replace if necessary                       |
| Tape unwinds or tension arm hits stop when the LOAD control is depressed                      | Tape is improperly threaded                              | Rethread tape (see Section III)                                             |
|                                                                                               | Fault in reel servo amplifier or capstan servo amplifier | Troubleshoot reel servo and repair as necessary                             |
| Tape runs past the BOT marker                                                                 | BOT tab dirty or tarnished                               | Replace tab or check sensitivity or photo-sensor amplifier (see Section VI) |
|                                                                                               | Photosensor or amplifier defective                       | Replace or repair photosensor assembly                                      |
| Transport does not move tape in response to Forward or Reverse command                        | Interface cable fault or receiver fault                  | Check levels at outputs and inputs of receivers. Replace or repair cable    |
|                                                                                               | Transport is not Ready or On Line                        | Bring tape to load point or place on line (see Section III)                 |

TABLE 8.2. SYSTEM TROUBLESHOOTING (CONTINUED)

| TROUBLE                                                               | PROBABLE CAUSE                                                            | REMEDY                                                                              |
|-----------------------------------------------------------------------|---------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Transport does not move etc., (con't.)                                | Transport is not Ready or On Line (con't)                                 | Troubleshoot control logic or servo amplifier                                       |
| Transport responds to remote FORWARD command, but tape is not written | Write current is not enabled.                                             | Check presence of Write Enable ring on supply reel, WRT EN indicator should be lit. |
|                                                                       | Write Enable signal is not correct                                        | Troubleshoot Control logic                                                          |
|                                                                       | Write Data or Write Data Strobe is not received correctly from interface. | Check interface                                                                     |
|                                                                       | Heads not plugged in correctly.                                           | Check connector                                                                     |
| Data are incorrectly written                                          | Incorrect data format                                                     | Use correct format                                                                  |
|                                                                       | Fault on one track due to failure in write circuits                       | Check receiver and write amplifier, repair if faulty.                               |
|                                                                       | Write deskew circuit faulty.                                              | Check skew adjustments (see Section VI)                                             |
|                                                                       | Head and guides need cleaning                                             | Clean head and guides                                                               |

TABLE 8.2. SYSTEM TROUBLESHOOTING (CONTINUED)

| TROUBLE             | PROBABLE CAUSE                                                                   | REMEDY                                                                    |
|---------------------|----------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Tape cannot be read | Interface cable fault                                                            | Replace or repair interface cable                                         |
|                     | Head is not plugged in                                                           | Check connector                                                           |
|                     | Read skew out of adjustment                                                      | Readjust in accordance with Section VI                                    |
|                     | Head and guides need cleaning                                                    | Clean head and guides                                                     |
|                     | Read amplifier gains are incorrectly adjusted                                    | Check and adjust amplifier gains                                          |
|                     | Faulty write amplifier may cause current to be passed through head while reading | Check write amplifier and repair as necessary                             |
|                     | Read Data Storage Register faulty.                                               | Check that duration of positive section of waveform is one-half bit time. |
|                     | Other component fault in read channel.                                           | Check test point data. Repair Read/Write board.                           |

TABLE 8.3. TROUBLESHOOTING CHART

| PROBLEM       | TEST FAILED                                                       | ACTION REQUIRED                                                                                                                                                                                                                                                    |
|---------------|-------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Errors   | Group 3<br>NRZI Write/Read data test<br>P.E. Write/Read data test | <ol style="list-style-type: none"><li>1. Perform Group 1, all tests.</li><li>2. Repeat Group 3, Test B or C.</li><li>3. Check all channels at Read amplifier at Test point TP6-14.</li><li>4. Signal trace to failed component, (Refer to procedure 7.3)</li></ol> |
| Servo Control | Group 3<br>Test A or D                                            | <ol style="list-style-type: none"><li>1. Perform Group 1, Tests A and B.</li><li>2. Perform Group 2, All Tests.</li><li>3. Signal Trace to failed component, (Refer to procedure 7.3)</li></ol>                                                                    |



TABLE 8.4. TEST POINT CHART

| TABLE 8.4. TEST POINT CHART |                |                                      |                                               |       |        |
|-----------------------------|----------------|--------------------------------------|-----------------------------------------------|-------|--------|
| TEST POINT                  | BOARD LOCATION | SIGNAL DESCRIPTION                   | VOLTAGE LEVELS                                |       |        |
| TP1                         | F7             | Capstan Tachometer                   | <div><div>45 IPS</div><div>25 IPS</div></div> |       |        |
|                             |                |                                      | LOAD                                          | +1.7V | +1.7V  |
|                             |                |                                      | FWD                                           | +1.3V | +0.72V |
|                             |                |                                      | REV                                           | -1.3V | -0.72V |
|                             |                |                                      | REW                                           | -4.0V | -4.0V  |
|                             |                |                                      | ULP                                           | -1.8V | -1.8V  |
| TP2                         | E10            | Ramp Generator                       | FWD                                           |       |        |
|                             |                |                                      | REV                                           |       |        |
|                             |                |                                      | REW                                           |       |        |
|                             |                |                                      | ULP                                           |       |        |
|                             |                |                                      |                                               |       |        |
| TP3                         | F5             | Output of 4J-1<br>Take-Up Reel Servo | LOAD                                          |       |        |
|                             |                |                                      | FWD                                           |       |        |
|                             |                |                                      | REV                                           |       |        |
|                             |                |                                      | REW                                           |       |        |
|                             |                |                                      | ULP                                           |       |        |
|                             |                |                                      |                                               |       |        |
| TP4                         | H6             | Output of 6J-1<br>Supply Reel Servo  | LOAD                                          |       |        |
|                             |                |                                      | FWD                                           |       |        |
|                             |                |                                      | REV                                           |       |        |
|                             |                |                                      | REW                                           |       |        |
|                             |                |                                      | ULP                                           |       |        |
|                             |                |                                      |                                               |       |        |
| TP5                         | J6             | Output of 6J-8<br>(HATL)             | LOAD                                          |       |        |
|                             |                |                                      | FWD                                           |       |        |
|                             |                |                                      | REV                                           |       |        |
|                             |                |                                      | REW                                           |       |        |
|                             |                |                                      | ULP                                           |       |        |
|                             |                |                                      |                                               |       |        |

8-10

TABLE 8.4. TEST POINT CHART (CONTINUED)

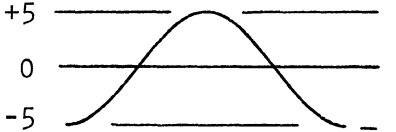
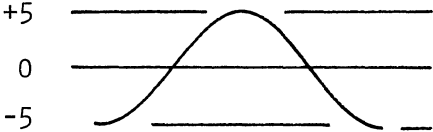
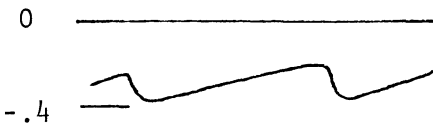
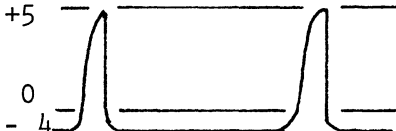
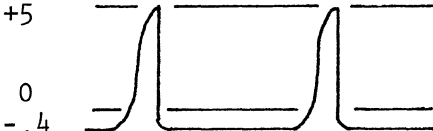
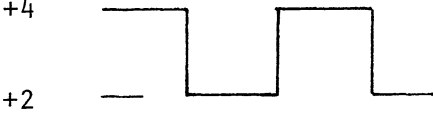
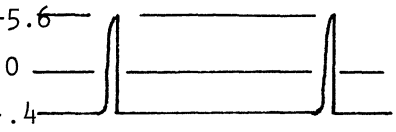
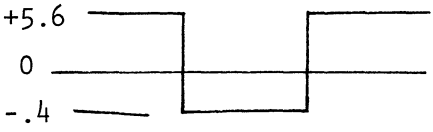
| TEST POINT         | BOARD LOCATION | SIGNAL DESCRIPTION | NRZI WAVEFORM(S)                                                                     | P.E. WAVEFORM(S)                                                                      |
|--------------------|----------------|--------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| TP6<br>to<br>TP14  | KV-14          | READ TRACK         |    |    |
| TP15<br>to<br>TP23 | KV-11          | READ TRACK         |    |    |
| TP24<br>to<br>TP32 | KV-8           | READ TRACK         |    |    |
| TP34<br>to<br>TP42 | KV-8           | READ TRACK         |    |    |
| TP43<br>to<br>TP51 | KV-7           | READ TRACK         |   |   |
| TP52               | P6             | SKEW-READ CONTROL  |  |  |

TABLE 8.4. TEST POINT CHART (CONTINUED)

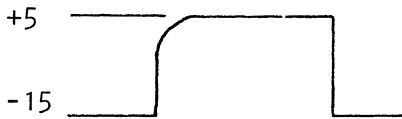
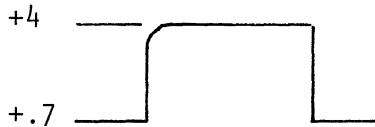
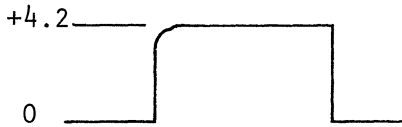
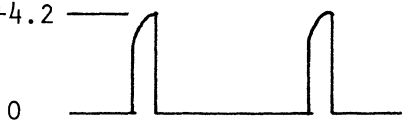
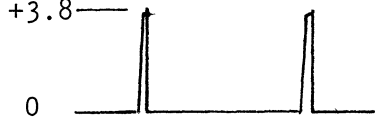
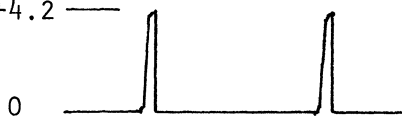
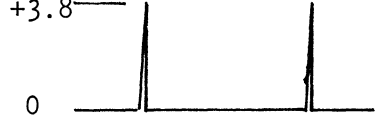
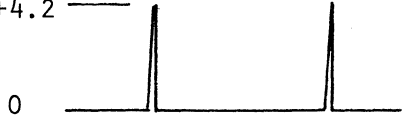
| TEST POINT | BOARD LOCATION | SIGNAL DESCRIPTION | NRZI WAVEFORM(S)                                                                     |                   |                          | P.E. WAVEFORM(S)                                                                      |                   |                           |
|------------|----------------|--------------------|--------------------------------------------------------------------------------------|-------------------|--------------------------|---------------------------------------------------------------------------------------|-------------------|---------------------------|
| TP53       | M6             | READ CONTROL       |    |                   |                          |    |                   |                           |
| TP54       | K6             | READ CONTROL       |    |                   |                          |    |                   |                           |
| TP55       | K6             | READ CONTROL       |    |                   |                          |    |                   |                           |
| TP56       | M6             | READ CONTROL       |    |                   |                          |    |                   |                           |
| TP57       | R6             | READ RESET         |  |                   |                          |  |                   |                           |
| TP58       | T6             | +T                 | HIDEN<br>UP                                                                          | LOT<br>MET<br>HIT | +0.39<br>+0.788<br>+1.58 | HIDEN<br>DOWN                                                                         | LOT<br>MET<br>HIT | +0.327<br>+0.499<br>+1.27 |
| TP59       | T6             | -T                 | HIDEN<br>UP                                                                          | LOT<br>MET<br>HIT | -0.401<br>-0.80<br>-1.63 | HIDEN<br>DOWN                                                                         | LOT<br>MET<br>HIT | -0.34<br>-0.51<br>-1.29   |

TABLE 8.4. TEST POINT CHART (CONTINUED)

| TEST POINT | BOARD LOCATION | SIGNAL DESCRIPTION                         | VOLTAGE LEVELS                       |
|------------|----------------|--------------------------------------------|--------------------------------------|
| TP60       | J8             | ALT<br>ARM LIMIT                           | 5V                                   |
| TP61       | H13            | OUTPUT OF 13H2<br>LAMP OUT (L)             | 5V/Goes to LOW (0) if sensor is out. |
| TP62       | V4             | OUTPUT OF 5T12<br>TEST WRITE<br>STROBE (L) | 5V                                   |
| TP63       | T3             | OUTPUT OF 5T10<br>TEST WRITE<br>DATA       | 0V                                   |
| +R         | D11            |                                            | +8.8 to +9.4VDC                      |
| -R         | D12            |                                            | -8.8 to -9.4VDC                      |
| +15V       | C11            |                                            | +14.25 to +15.75VDC                  |
| +5V        | E11            |                                            | Adj to +5.00VDC                      |
| -15V       | D12            |                                            | -14.25 to -15.75VDC                  |
| +20V       | C17            |                                            | +23 to +27VDC                        |
| -20        | C16            |                                            | -23 to -27VDC                        |

TABLE 8.5. TDI 1050 CIRCUIT BOARD ADJUSTMENTS

| AJDUSTMENT | DESCRIPTION                                       | CIRCUIT |
|------------|---------------------------------------------------|---------|
| R6         | Voltage Divider +R/-R                             |         |
| R15        | Voltage Divider +R/-R                             |         |
| R22        | Voltage Divider +R/GROUND                         |         |
| R28        | Voltage Divider +R/-R                             |         |
| R66        | Power Regulator Adjust.                           |         |
| R77        | Voltage Divider +R/-R<br>Take-up Servo Adjustment |         |
| R85        | Take-Up Servo Adjustment                          |         |

TABLE 8.5. TDI 1050 CIRCUIT BOARD ADJUSTMENTS (CONTINUED)

| ADJUSTMENT    | DESCRIPTION                               | CIRCUIT |
|---------------|-------------------------------------------|---------|
| R97           | Voltage Divider +R/-R                     |         |
| R105          | Supply Servo Adjustment                   |         |
| R326/<br>R334 | Read Channel Adjustment                   |         |
| R335/<br>R343 | Read Channel Adjustment                   |         |
| R496          | HI DENSITY ADJUSTMENT                     |         |
| R498          | LO DENSITY ADJUSTMENT                     |         |
| R516          | Frequency Adjustment<br>Vco Write Control |         |



TANDEM

SECTION IX  
DIAGRAMS



## SECTION IX

### DIAGRAMS

#### 9.1 INTRODUCTION

This section contains the logic, schematic and assembly diagrams necessary for maintenance and/or troubleshooting the tape transport.

#### 9.2 LOGIC SYMBOLS

Table 9.1 shows the logic symbols, including truth tables, for the IC's used in the TDI 1050 Series. Table 9.2 and 9.3 show the logic symbols and truth tables for the D-Type and JK flipflops respectively.

TABLE 9.1. LOGIC SYMBOLOGY AND TRUTH TABLES

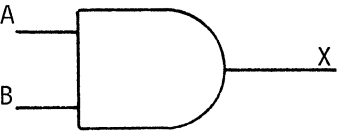
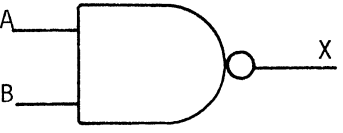
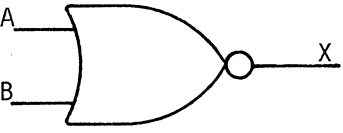
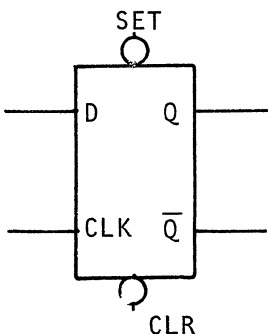
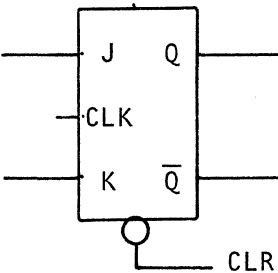
| TYPE | SYMBOL                                                                              | A                | B                | X                |
|------|-------------------------------------------------------------------------------------|------------------|------------------|------------------|
| AND  |  | H<br>H<br>L<br>L | H<br>L<br>H<br>L | H<br>L<br>L<br>L |
| NAND |  | H<br>H<br>L<br>L | H<br>L<br>H<br>L | L<br>H<br>H<br>H |
| NOR  |  | H<br>H<br>L<br>L | H<br>L<br>H<br>L | L<br>L<br>L<br>H |
| OR   |  | H<br>H<br>L<br>L | H<br>L<br>H<br>L | H<br>H<br>H<br>L |

TABLE 9.2. D-TYPE FLIPFLOP

| TYPE    | SYMBOL                                                                            | D      | Q      | $\bar{Q}$ |
|---------|-----------------------------------------------------------------------------------|--------|--------|-----------|
| D- TYPE |  | L<br>H | L<br>H | H<br>L    |

Information is transferred from D input to Q at a predetermined level of the positive going edge of the clock pulse.

TABLE 9.3. JK FLIPFLOP

| TYPE | SYMBOL                                                                              | $t_n$ |   | $t_{n+2}$ |
|------|-------------------------------------------------------------------------------------|-------|---|-----------|
| JK   |  | J     | K | Q         |
|      |                                                                                     | L     | L | $Q_n$     |
|      |                                                                                     | L     | H | L         |
|      |                                                                                     | H     | L | H         |
|      |                                                                                     | H     | H | $Q_n$     |

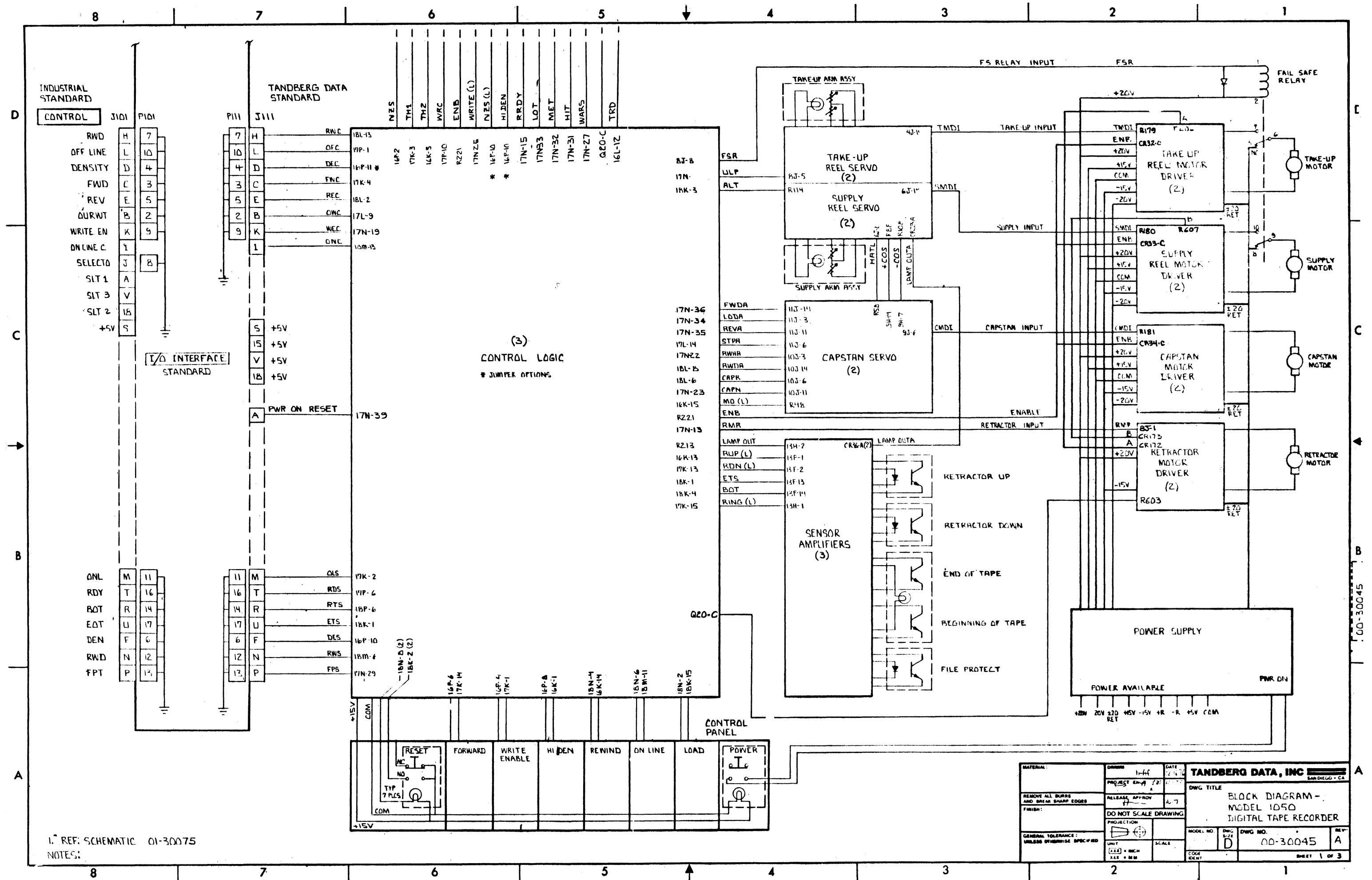
Data is accepted when the inputs are enabled by the clock going high. Input data is transferred to the outputs on the negative going edge of the clock.

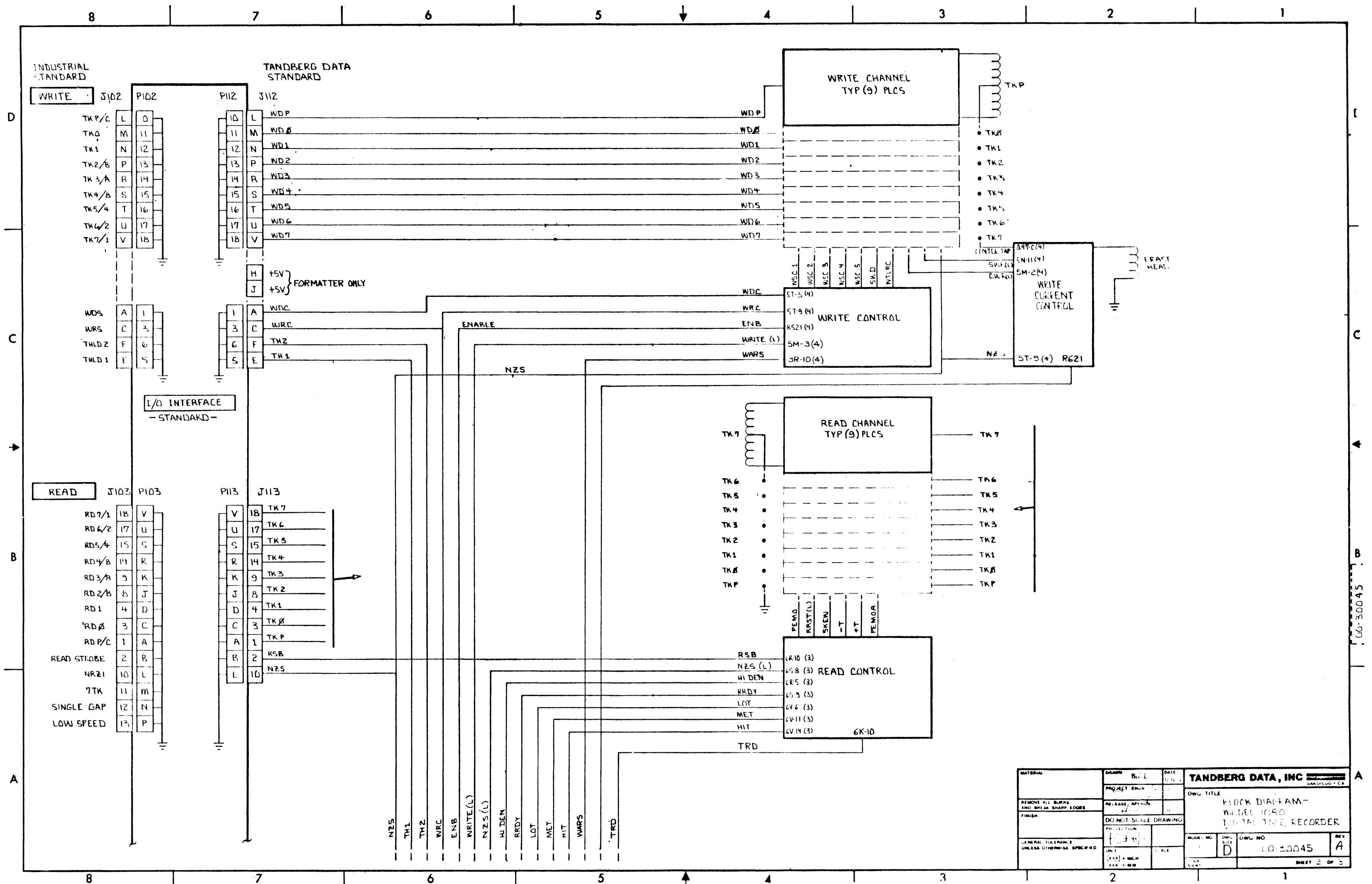
### 9.3 LISTING

The Engineering drawings contained herein are listed below in the order of their appearance.

| DRAWING NO. | TITLE                                                            | NO. OF PAGES |
|-------------|------------------------------------------------------------------|--------------|
| 10-00045    | FINAL ASSY- Model 1051 Drive, Standalone, Syn.<br>Tape Transport | 1            |
| 00-30045    | BLOCK DIAGRAM- Digital Tape Recorder                             | 3            |
| 11-00075    | PCB ASSY- Main Electronics                                       | 1            |
| 01-30075    | SCHEMATIC- Main Electronics                                      | 5            |
| 11-00003    | I/O INTERFACE- Mod. 1051 - Industry Std.                         | 1            |
| 01-30003    | SCHEMATIC- I/O Interface, Industry Std.                          | 1            |
| 00-90008    | CABLE INSTALLATION/ROUTING                                       | 1            |
| 11-10054    | MECH ASSY- Top Plate                                             | 2            |
| 11-10030    | MECH ASSY- Roller Guide, Top Plate                               | 1            |
| 11-10031    | MECH ASSY- Roller Guide, Compliance Arm                          | 1            |
| 11-10040    | MECH ASSY- Compliance Arm                                        | 1            |
| 11-10041    | MECH ASSY- Headplate                                             | 1            |
| 00-90005    | Main PCB Removal                                                 | 1            |
| 00-90006    | Power Supply Removal                                             | 1            |



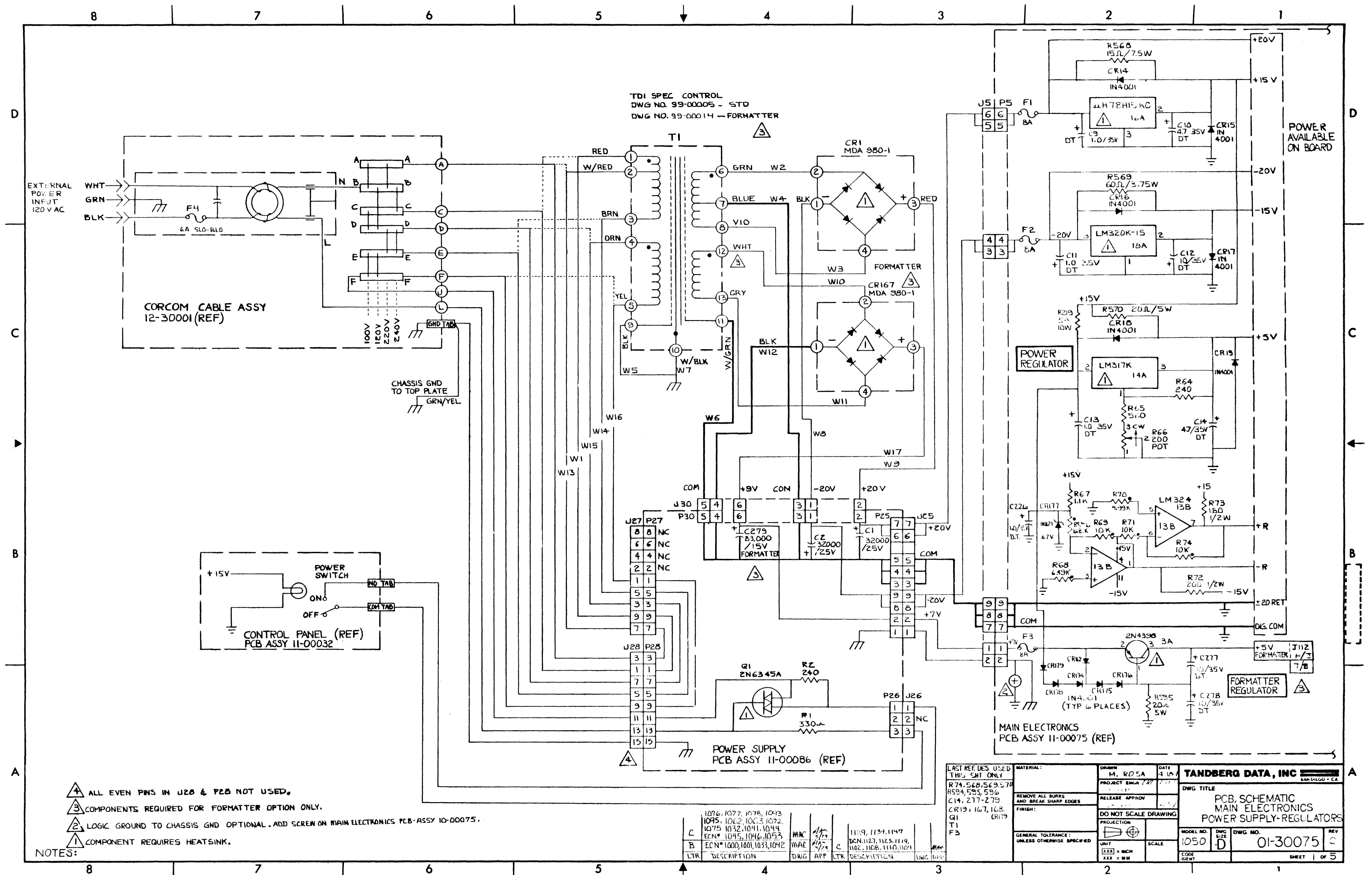


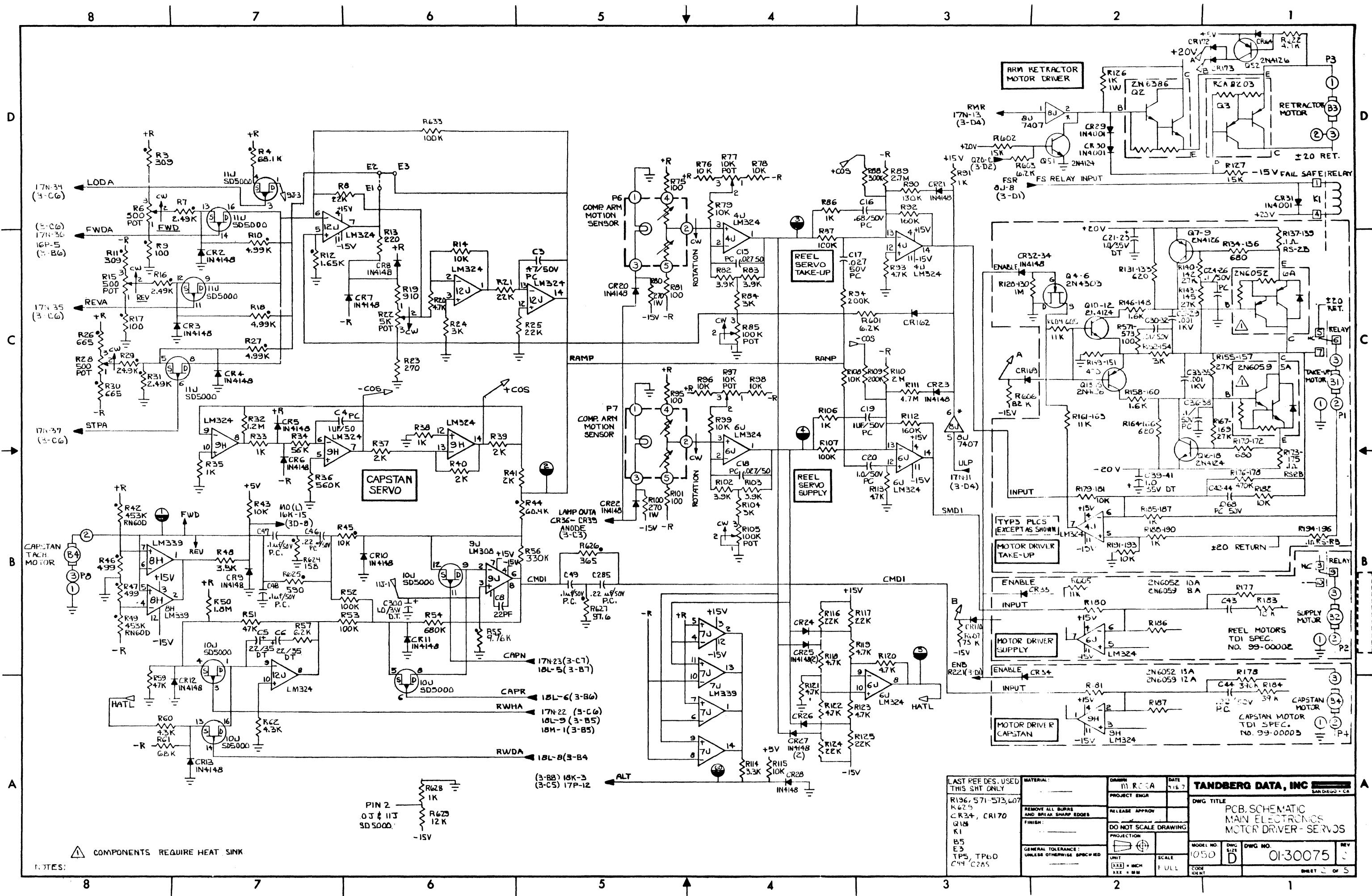




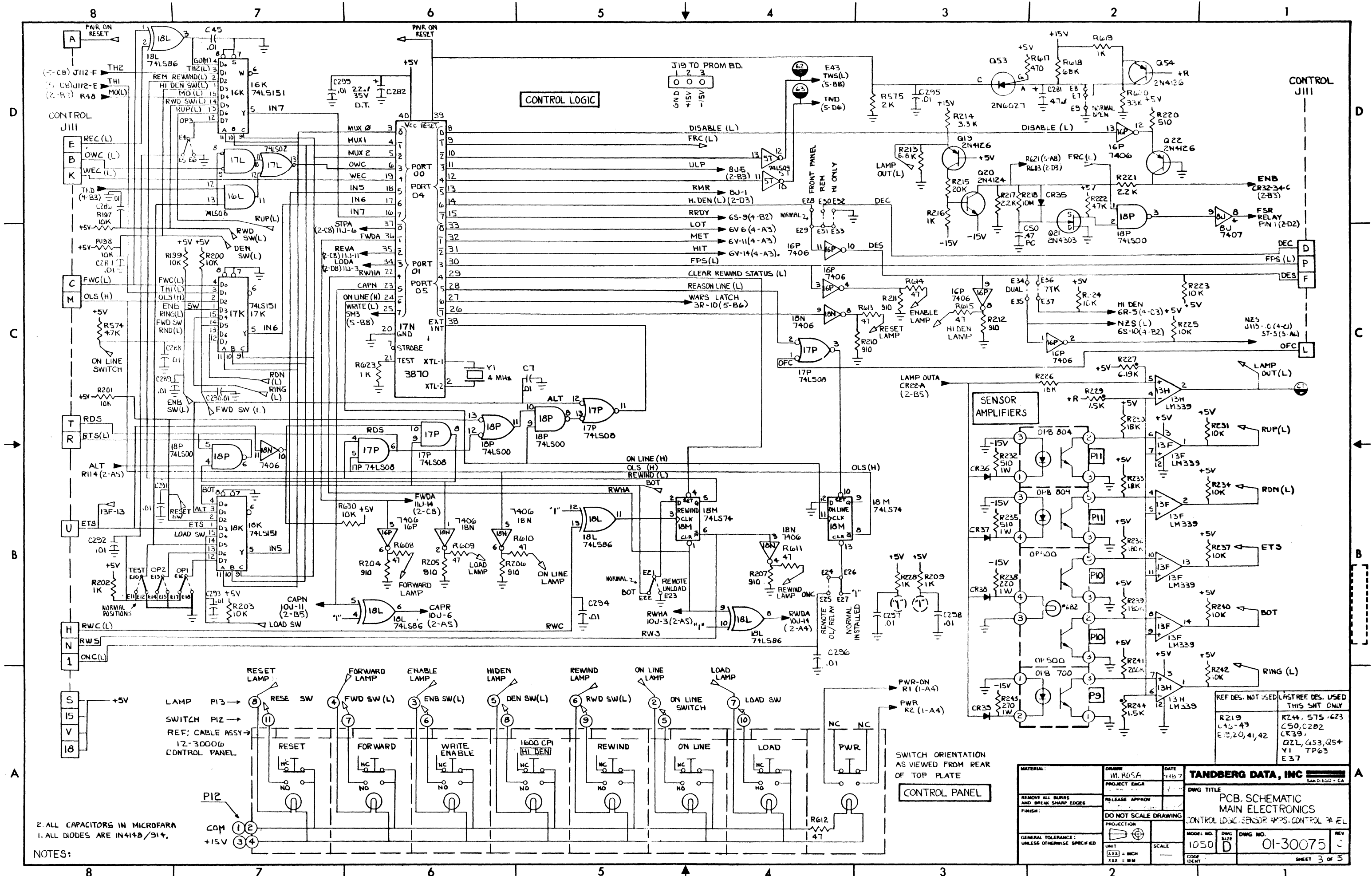


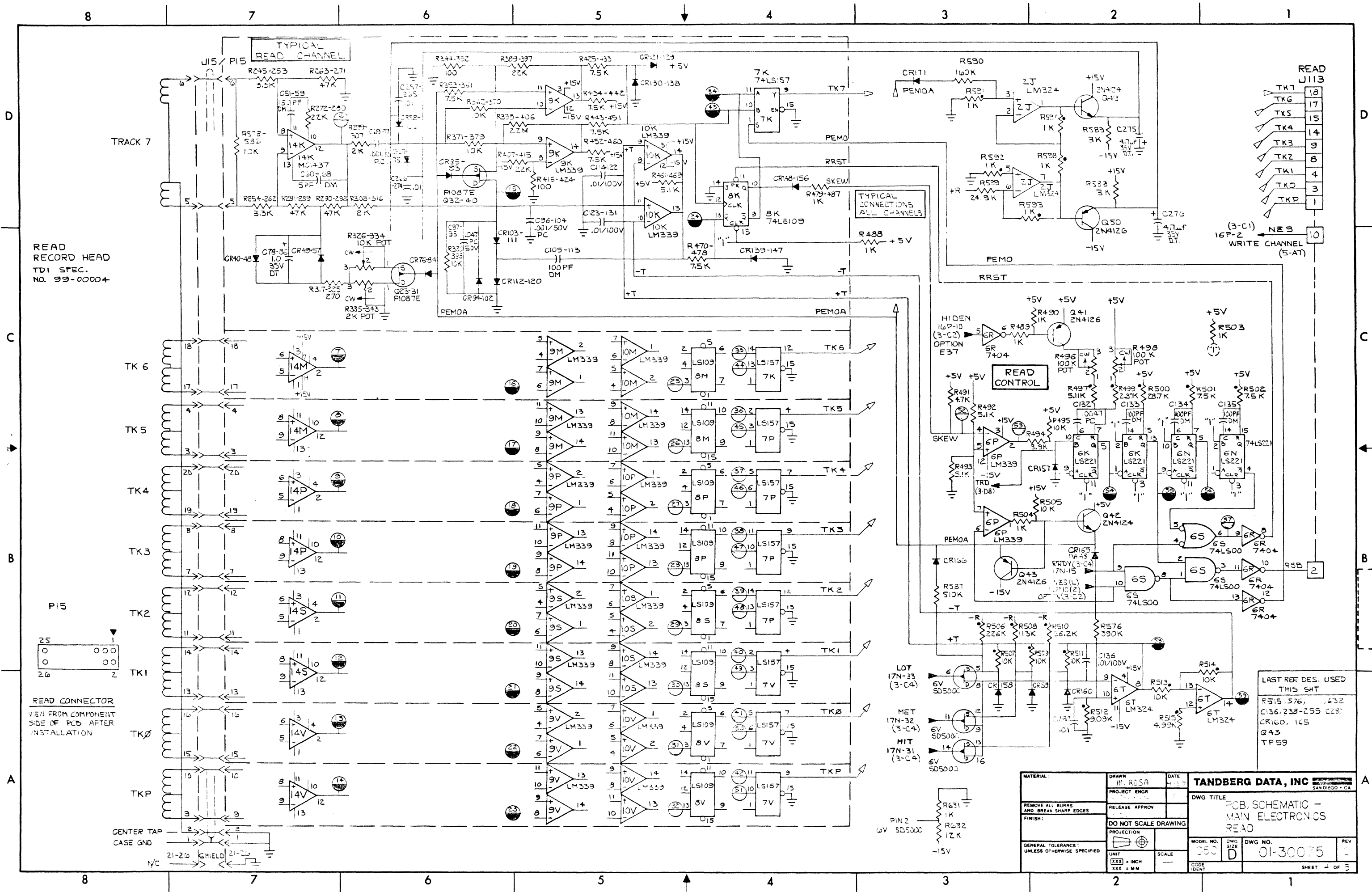






|                                   |  |                                               |  |                           |  |                 |  |                    |  |
|-----------------------------------|--|-----------------------------------------------|--|---------------------------|--|-----------------|--|--------------------|--|
| LAST REF DES. USED THIS SHIT ONLY |  | MATERIAL:                                     |  | DESIGN: M. ROSE           |  | DATE: 1/15/77   |  | TANDBERG DATA, INC |  |
| R196, 571-573, 607                |  | REMOVE ALL BURRS AND BRIM SHARP EDGES         |  | PROJECT ENGR:             |  | RELEASE APPROV: |  | DWG TITLE          |  |
| R62.9                             |  | FINISH:                                       |  | DO NOT SCALE DRAWING      |  | PROJECTION:     |  | PCB SCHEMATIC      |  |
| CR34, CR170                       |  | GENERAL TOLERANCE: UNLESS OTHERWISE SPECIFIED |  | UNIT: [X] = INCH [X] = MM |  | SCALE: FULL     |  | MAIN ELECTRONICS   |  |
| Q18                               |  | UNIT: [X] = INCH [X] = MM                     |  | SCALE: FULL               |  | MODEL NO. 1050  |  | DWG NO. 01-30075   |  |
| K1                                |  | UNIT: [X] = INCH [X] = MM                     |  | SCALE: FULL               |  | CODE: [X]       |  | REV                |  |
| B5                                |  | UNIT: [X] = INCH [X] = MM                     |  | SCALE: FULL               |  | CODE: [X]       |  | REV                |  |
| E3                                |  | UNIT: [X] = INCH [X] = MM                     |  | SCALE: FULL               |  | CODE: [X]       |  | REV                |  |
| TP5, TP60                         |  | UNIT: [X] = INCH [X] = MM                     |  | SCALE: FULL               |  | CODE: [X]       |  | REV                |  |
| C44, C285                         |  | UNIT: [X] = INCH [X] = MM                     |  | SCALE: FULL               |  | CODE: [X]       |  | REV                |  |





READ  
RECORD HEAD  
TDI SPEC.  
NO. 99-00004

READ CONNECTOR  
VIEW FROM COMPONENT  
SIDE OF PCB AFTER  
INSTALLATION

CENTER TAP  
CASE GND  
21-26 GND 21-26

LOT  
17N-33  
(3-C4)  
6V SDS500L

MET  
17N-32  
(3-C4)  
6V SDS500L

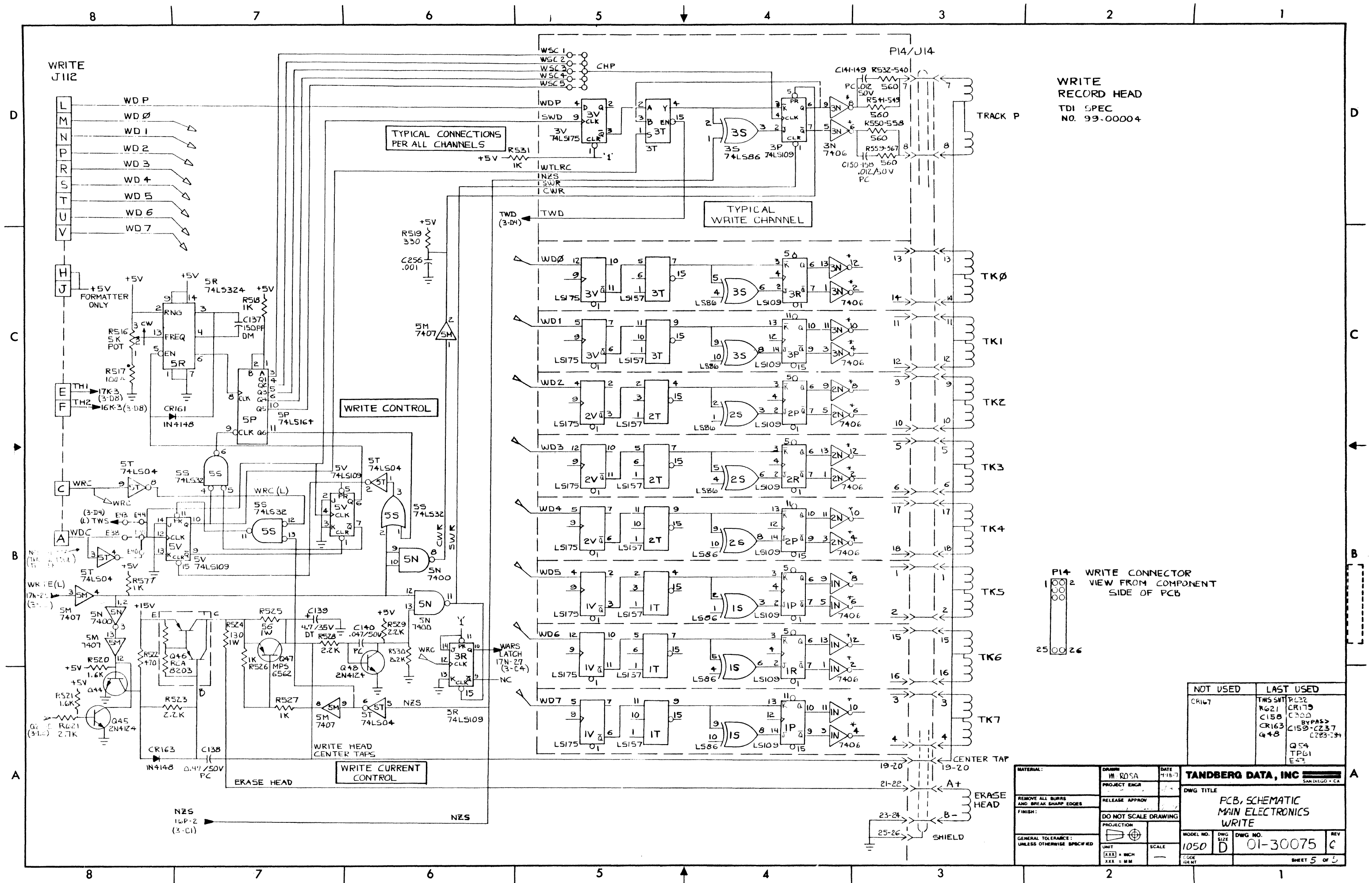
HIT  
17N-31  
(3-C4)  
6V SDS500L

PIN 2  
6V SDS500L  
R631 1K  
R632 12K  
-15V

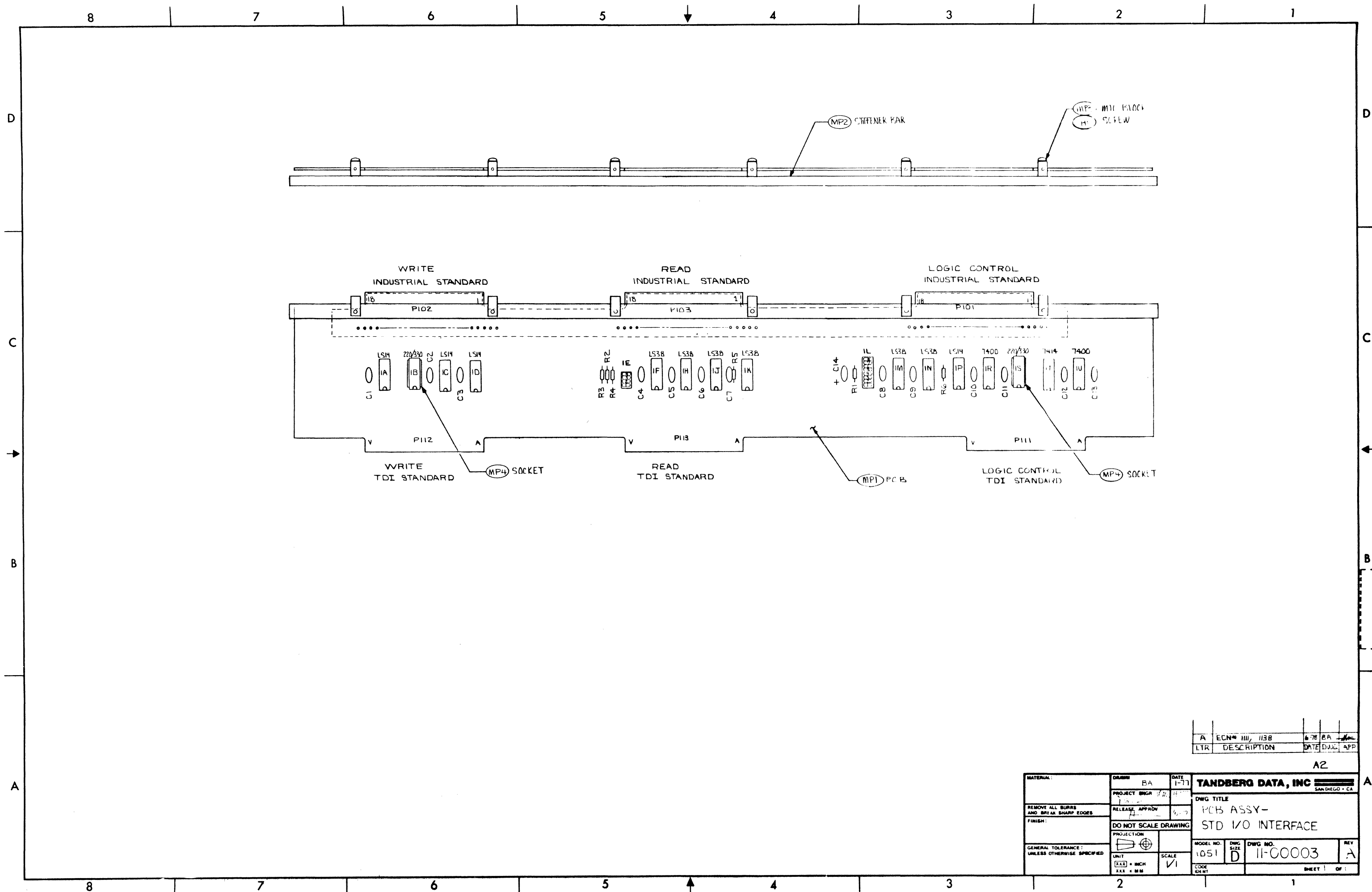
LAST REF DES. USED  
THIS SHT

R515, 576, 132  
C136, 238-255 C28  
CR160, 165  
Q43  
TP59

|                                                  |  |                      |      |                                              |          |
|--------------------------------------------------|--|----------------------|------|----------------------------------------------|----------|
| MATERIAL:                                        |  | DRAWN                | DATE | TANDBERG DATA, INC                           |          |
| REMOVE ALL BURRS<br>AND BREAK SHARP EDGES        |  | PROJECT ENGR         |      | SAN DIEGO - CA                               |          |
| FINISH:                                          |  | RELEASE APPROV       |      | DWG TITLE                                    |          |
| GENERAL TOLERANCE:<br>UNLESS OTHERWISE SPECIFIED |  | DO NOT SCALE DRAWING |      | PCB, SCHEMATIC -<br>MAIN ELECTRONICS<br>READ |          |
| UNIT                                             |  | PROJECTION           |      | MODEL NO.                                    | DWG NO.  |
| XXX = INCH<br>XXX = MM                           |  | SCALE                |      | 050                                          | 01-30075 |
| CODE IDENT                                       |  |                      |      | REV                                          |          |
|                                                  |  |                      |      | 1                                            |          |
|                                                  |  |                      |      | SHEET 4 OF 5                                 |          |





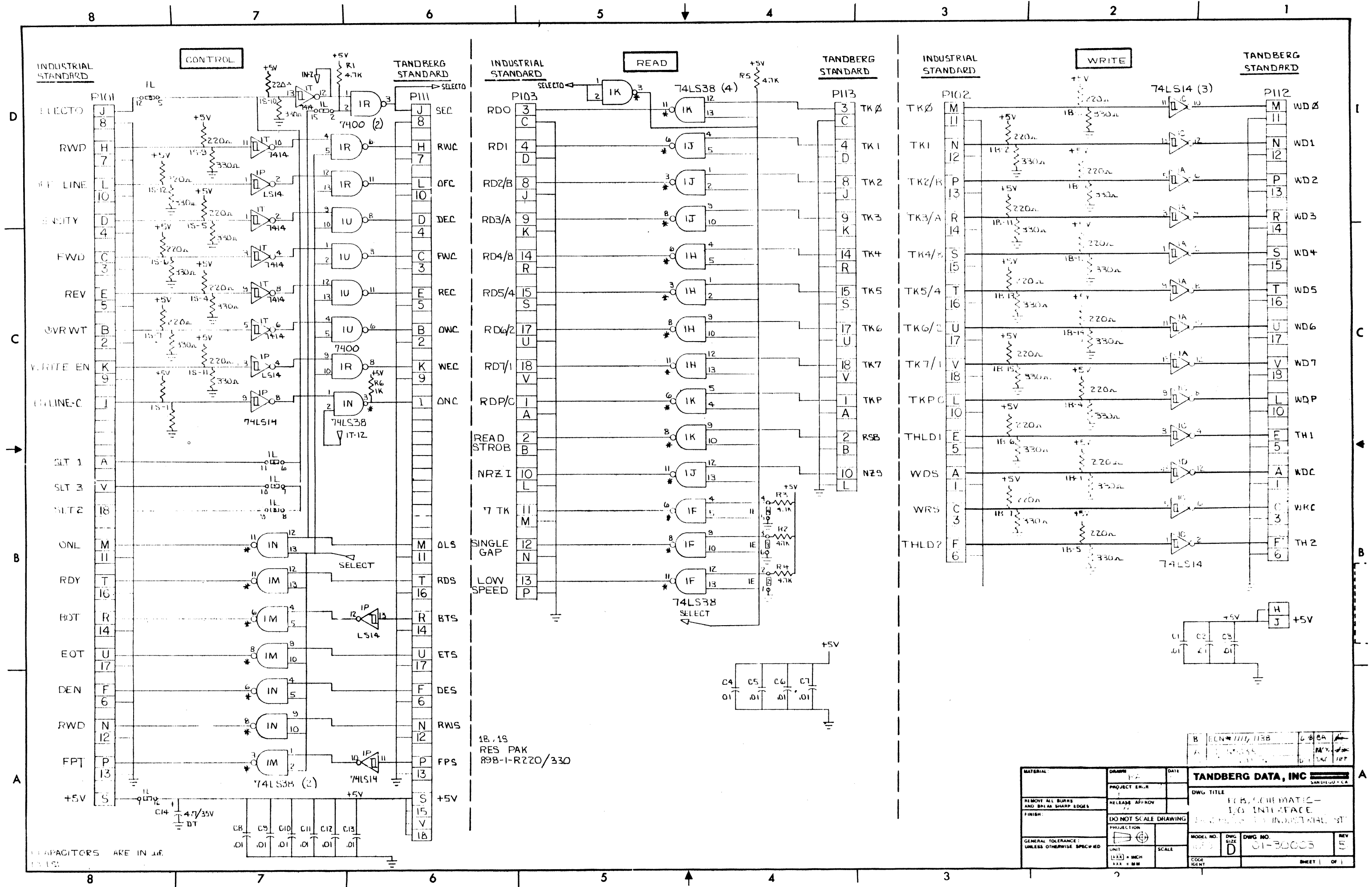


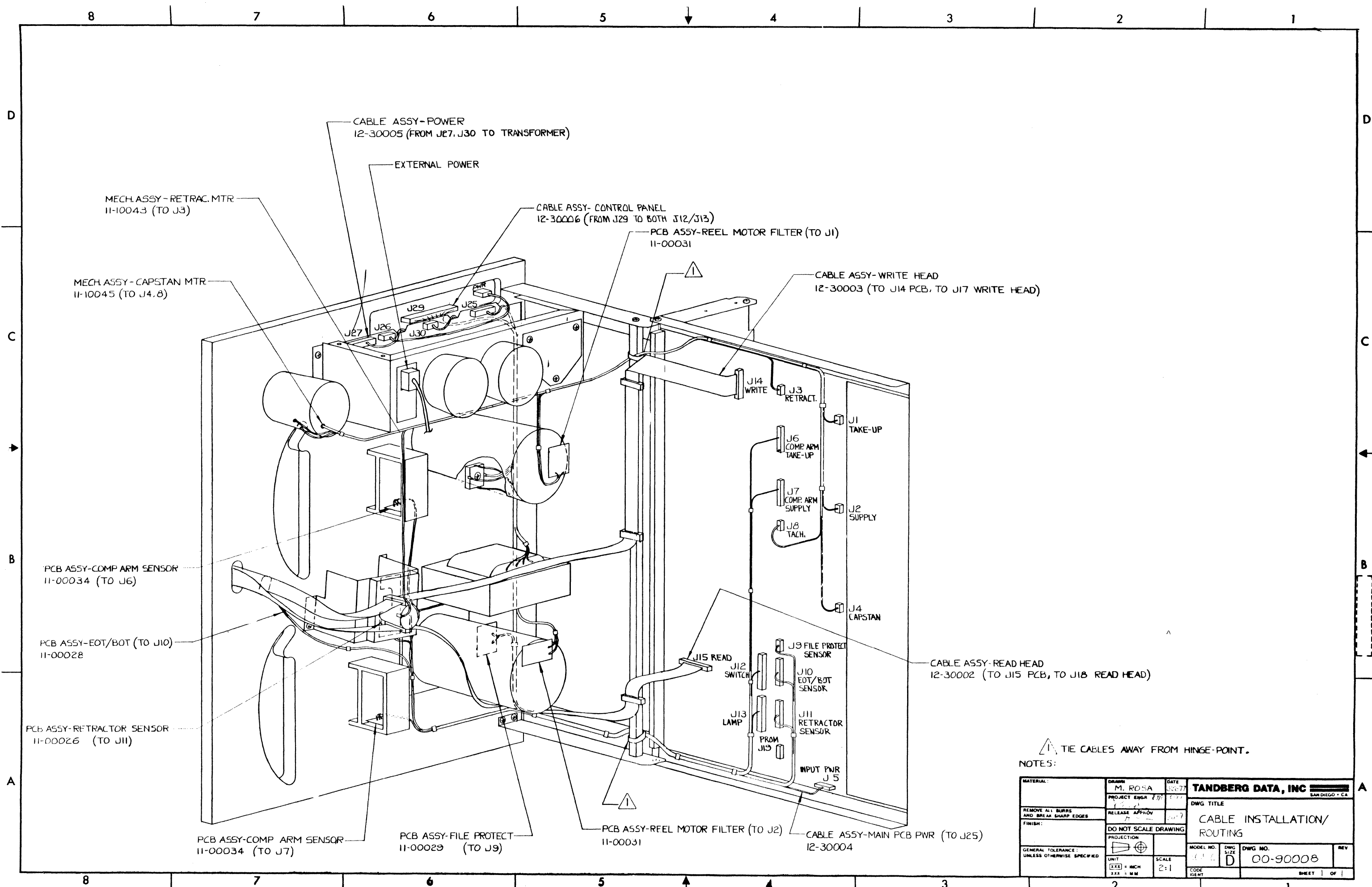
|     |                 |      |     |     |
|-----|-----------------|------|-----|-----|
| A   | ECN# 1111, 1138 | 6-78 | BA  |     |
| LTR | DESCRIPTION     | DATE | DWG | APP |

|                                               |  |              |         |          |
|-----------------------------------------------|--|--------------|---------|----------|
| MATERIAL:                                     |  | DATE         | 1-77    |          |
| PROJECT: BGR                                  |  | DATE         | 1-77    |          |
| RELEASE: APPROV                               |  | DATE         | 1-77    |          |
| DO NOT SCALE DRAWING                          |  |              |         |          |
| PROJECTION                                    |  |              |         |          |
| GENERAL TOLERANCE: UNLESS OTHERWISE SPECIFIED |  |              |         |          |
| UNIT: (XXX) = INCH<br>XXX = MM                |  | SCALE        | VI      |          |
| CODE IDENT                                    |  | MODEL NO.    | DWG NO. | REV      |
|                                               |  | 1051         | D       | 11-00003 |
|                                               |  | SHEET 1 OF 1 |         |          |

**TANDBERG DATA, INC.**  
SAN DIEGO - CA

DWG TITLE  
PCB ASSY-  
STD I/O INTERFACE

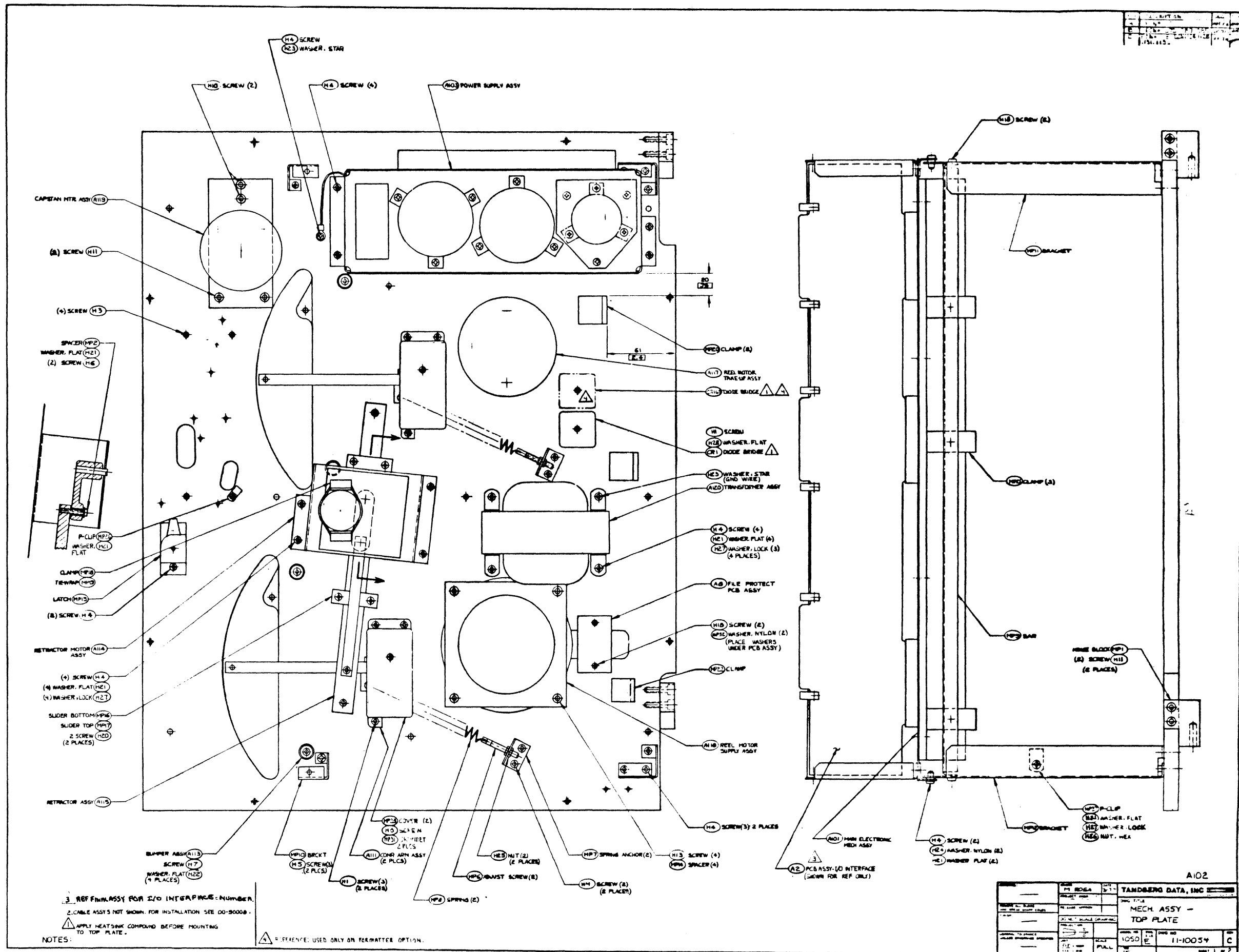


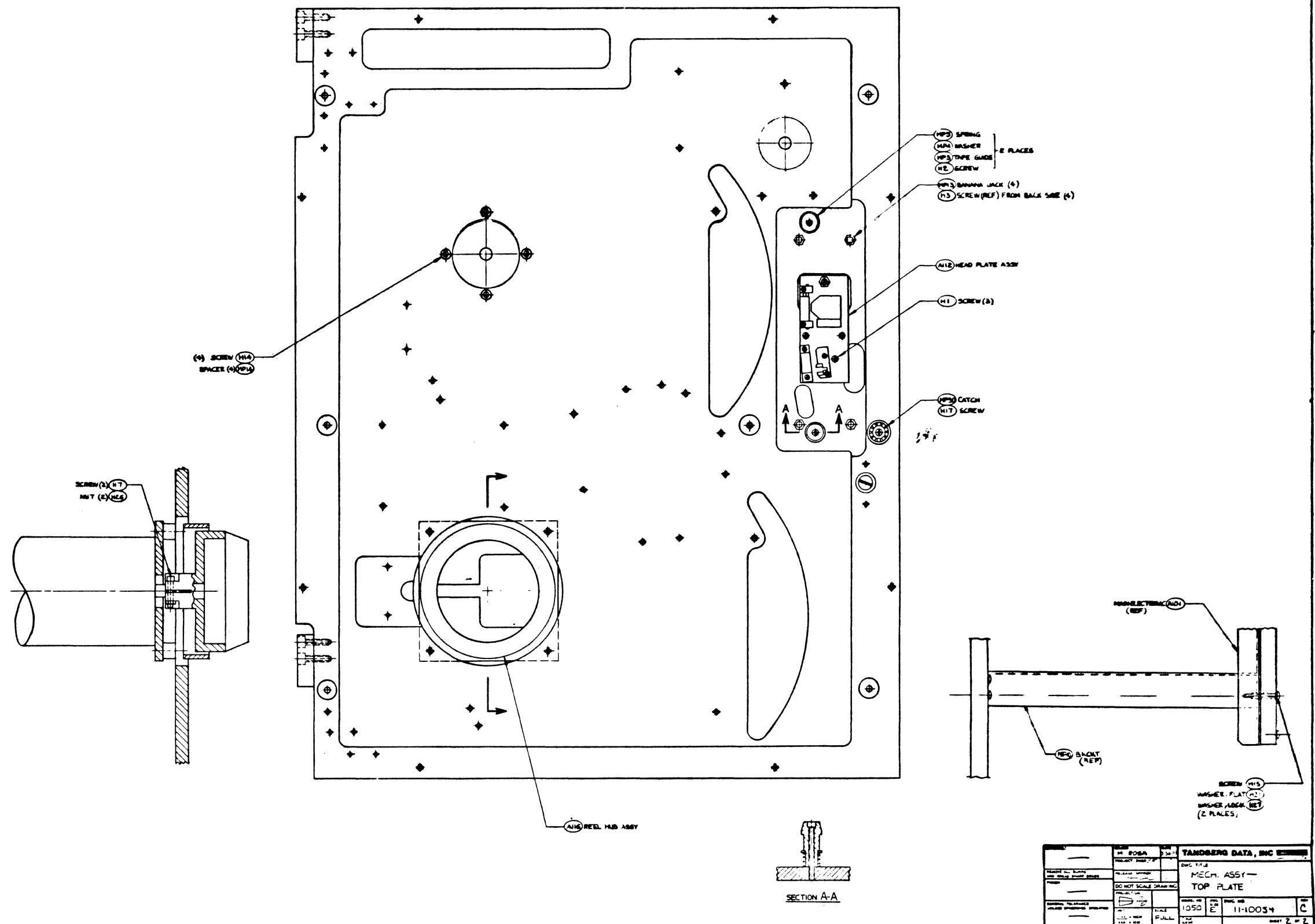


NOTES:  
 TIE CABLES AWAY FROM HINGE-POINT.

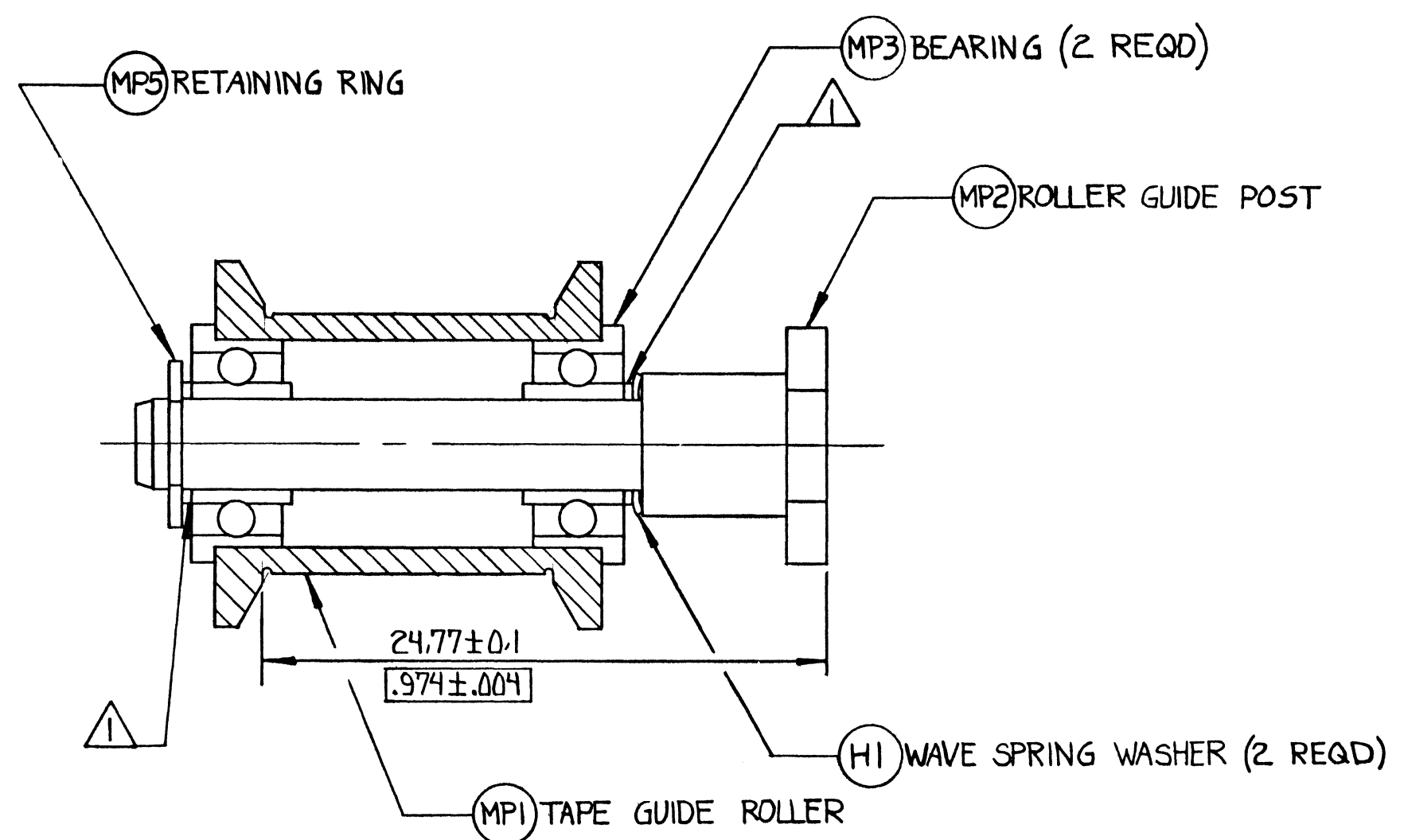
|                                                  |                                |                 |                                             |     |
|--------------------------------------------------|--------------------------------|-----------------|---------------------------------------------|-----|
| MATERIAL:                                        | DRAWN<br>M. ROSA               | DATE<br>5-27-77 | TANDBERG DATA, INC.<br>SAN DIEGO - CA       |     |
|                                                  | PROJECT ENGR<br>1/77           | 3-77            | DWG TITLE<br>CABLE INSTALLATION/<br>ROUTING |     |
| REMOVE ALL BURRS<br>AND BREAK SHARP EDGES        | RELEASE APPROV<br>1/77         | 3-77            | DO NOT SCALE DRAWING                        |     |
| FINISH:                                          | PROJECTION                     |                 | MODEL NO.<br>D                              |     |
| GENERAL TOLERANCE:<br>UNLESS OTHERWISE SPECIFIED | UNIT<br>XXX = INCH<br>XXX = MM | SCALE<br>2:1    | DWG NO.<br>00-90008                         | REV |
|                                                  |                                |                 | SHEET 1 OF 1                                |     |







| LTR | DESCRIPTION | DWN       | APP |
|-----|-------------|-----------|-----|
| A   | ECN#1014    | MAE 11/74 | ✓   |



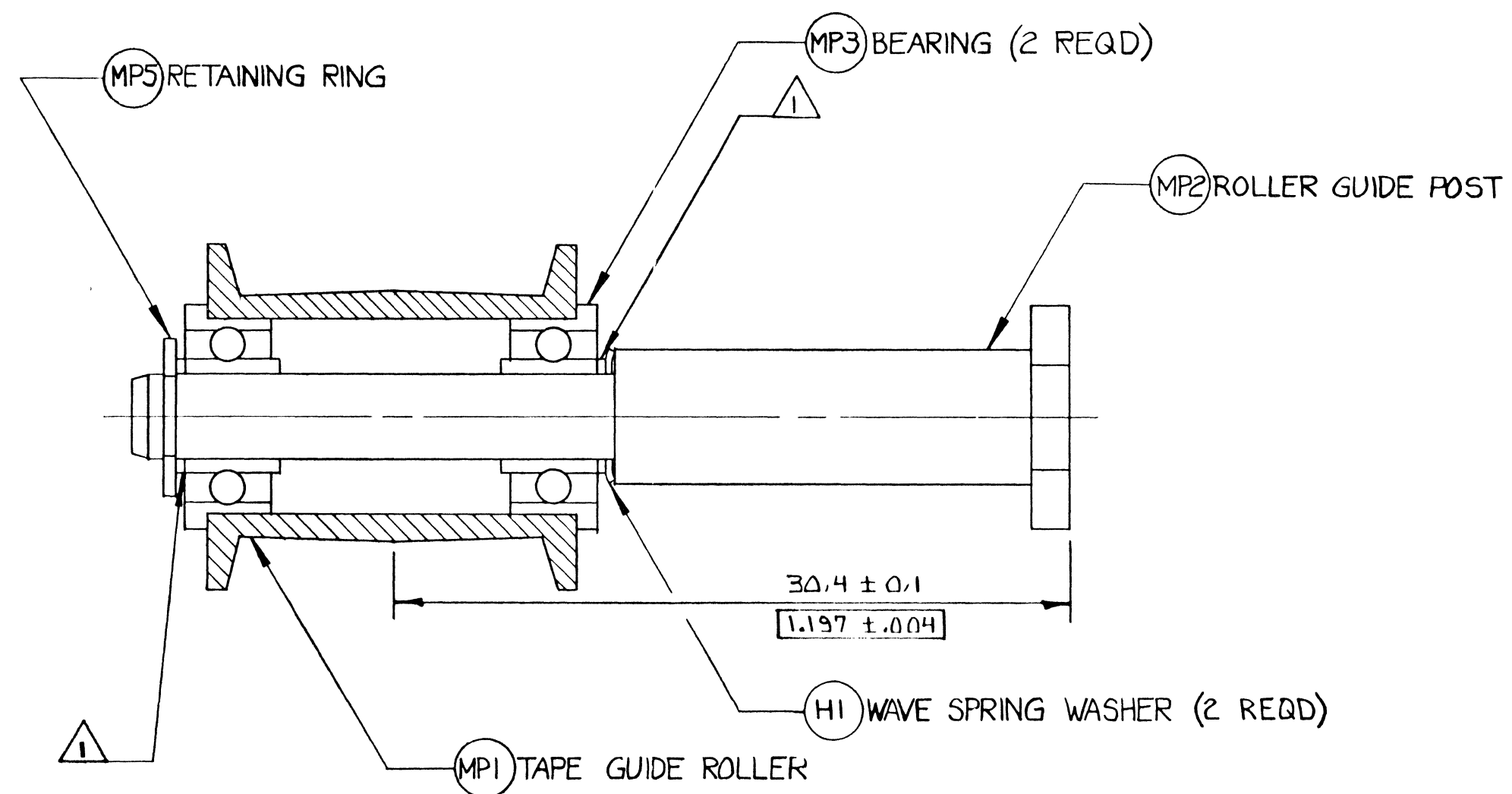
A104

1. SHIM ABOVE WAVE SPRINGS AND BELOW RETAINING RING AS REQ'D TO ACHIEVE A BASE TO ROLLER FLANGE DIMENSION OF  $24.77 \pm 0.1$   $.974 \pm .004$ . FOR PROPER WAVE SPRING COMPRESSION, THE TOTAL THICKNESS OF SHIMS USED MUST EQUAL  $0.64 \pm 0.05$   $.025 \pm .002$

NOTES:

|                                                           |                                |                    |                                                            |                     |          |
|-----------------------------------------------------------|--------------------------------|--------------------|------------------------------------------------------------|---------------------|----------|
| MATERIAL:<br>_____                                        | DRAWN<br>M. ROSA               | DATE<br>11-30-74   | <b>TANDBERG DATA, INC</b><br><small>SAN DIEGO • CA</small> |                     |          |
|                                                           | PROJECT ENGR<br>KRO            | 10-5-77<br>10/6/77 |                                                            |                     |          |
| REMOVE ALL BURRS AND BREAK SHARP EDGES                    | RELEASE APPROV<br>H            | 107                | DWG TITLE<br>ROLLER TAPE GUIDE ASSY TOP PLATE              |                     |          |
| FINISH:<br>_____                                          | DO NOT SCALE DRAWING           |                    |                                                            |                     |          |
| GENERAL TOLERANCE:<br>UNLESS OTHERWISE SPECIFIED<br>_____ | PROJECTION<br>                 |                    | MODEL NO.<br>1050                                          | DWG NO.<br>11-10030 | REV<br>A |
|                                                           | UNIT<br>XXX = INCH<br>XXX = MM | SCALE<br>4X        | CODE IDENT                                                 |                     |          |
|                                                           |                                |                    | SHEET 1 OF 1                                               |                     |          |

| LTR | DESCRIPTION | DWG | APP |
|-----|-------------|-----|-----|
| A   | ECN# 1013   | WAE | YZ  |

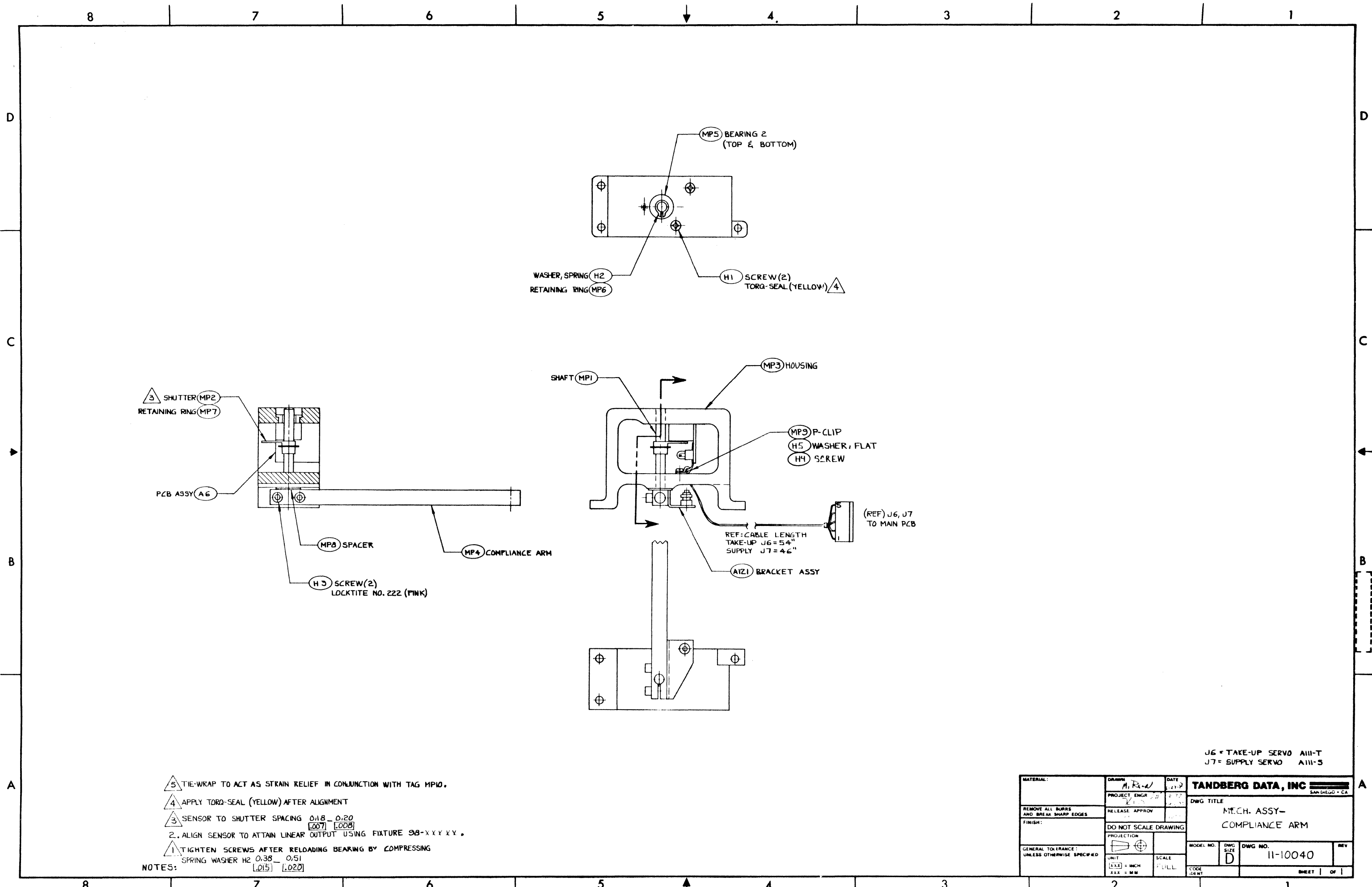


A105

⚠ SHIM ABOVE WAVE SPRINGS AND BELOW RETAINING RING AS REQ'D TO ACHIEVE A BASE TO ROLLER DRUM CROWN DIMENSION OF  $30.4 \pm 0.1$   $[1.197 \pm 0.004]$ . FOR PROPER WAVE SPRING COMPRESSION, THE TOTAL THICKNESS OF SHIMS USED MUST EQUAL  $0.64 \pm 0.05$   $[.025 \pm .002]$

NOTES:

|                                                                                                                                                              |                                |                    |                                                  |               |                     |          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|--------------------|--------------------------------------------------|---------------|---------------------|----------|
| MATERIAL:<br>_____<br><br>REMOVE ALL BURRS<br>AND BREAK SHARP EDGES<br><br>FINISH:<br>_____<br><br>GENERAL TOLERANCE:<br>UNLESS OTHERWISE SPECIFIED<br>_____ | DRAWN<br>M. ROSA               | DATE<br>11-30-76   | TANDBERG DATA, INC<br>SAN DIEGO • CA             |               |                     |          |
|                                                                                                                                                              | PROJECT ENGR<br>XEN            | 10-5-77<br>11/2/77 |                                                  |               |                     |          |
|                                                                                                                                                              | RELEASE APPROV<br>[Signature]  | 10-7               | DWG TITLE<br>ROLLER TAPE GUIDE ASSY<br>COMP. ARM |               |                     |          |
|                                                                                                                                                              | DO NOT SCALE DRAWING           |                    |                                                  |               |                     |          |
|                                                                                                                                                              | PROJECTION<br>[Symbol]         |                    | MODEL NO.<br>1050                                | DWG SIZE<br>B | DWG NO.<br>11-10031 | REV<br>A |
|                                                                                                                                                              | UNIT<br>XXX = INCH<br>XXX = MM | SCALE<br>4X        | CODE IDENT                                       |               | SHEET 1 OF 1        |          |

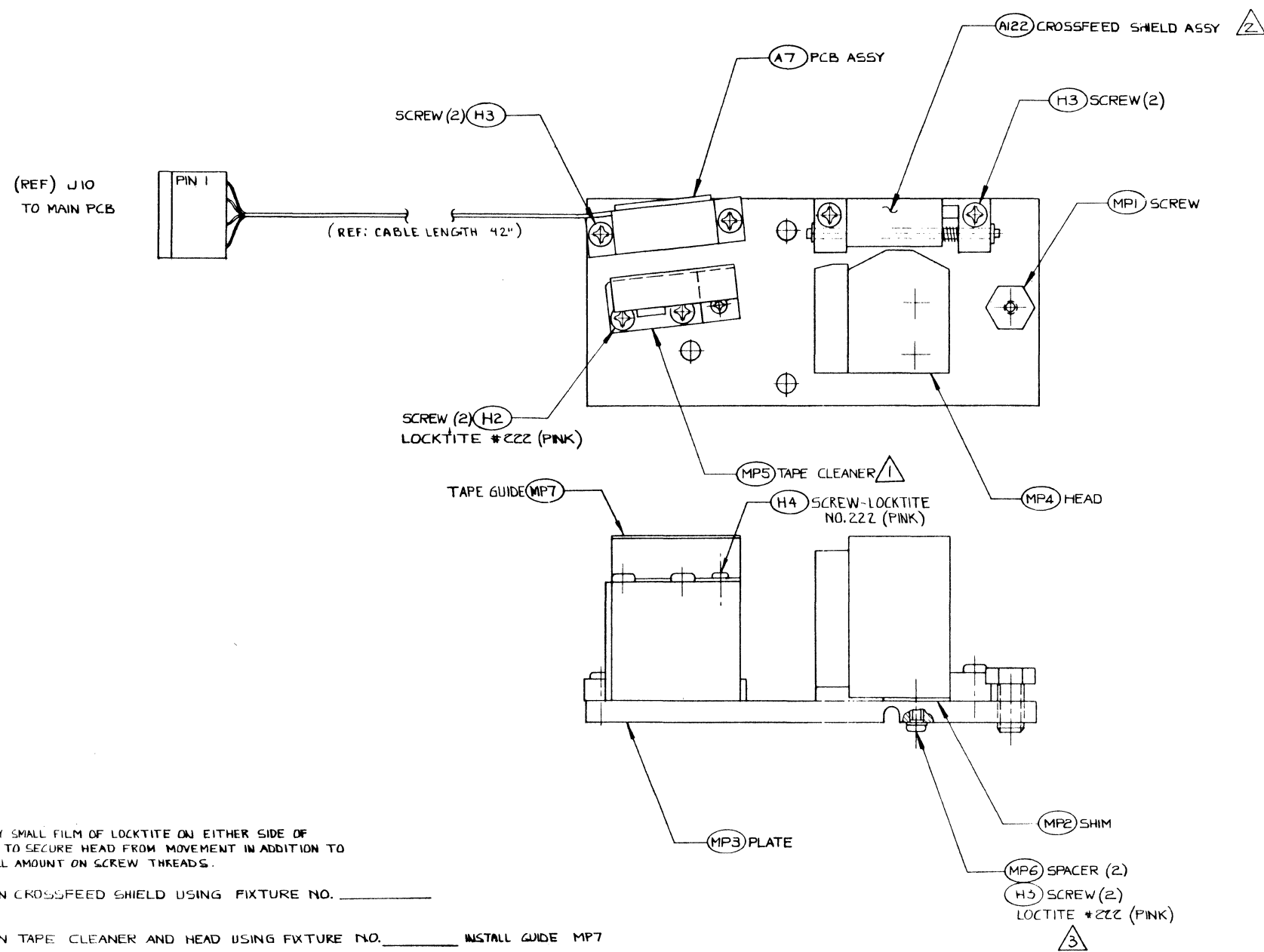


- NOTES:
- 5. TIE-WRAP TO ACT AS STRAIN RELIEF IN CONJUNCTION WITH TAG MPI0.
  - 4. APPLY TORQ-SEAL (YELLOW) AFTER ALIGNMENT
  - 3. SENSOR TO SHUTTER SPACING  $0.18 - 0.20$   
[.007] [.008]
  - 2. ALIGN SENSOR TO ATTAIN LINEAR OUTPUT USING FIXTURE 98-XXXXXY.
  - 1. TIGHTEN SCREWS AFTER RELOADING BEARING BY COMPRESSING  
SPRING WASHER H2  $0.38 - 0.51$   
[.015] [.020]

J6 = TAKE-UP SERVO AIII-T  
J7 = SUPPLY SERVO AIII-S

|                                                |  |                       |                       |                                                   |                         |
|------------------------------------------------|--|-----------------------|-----------------------|---------------------------------------------------|-------------------------|
| MATERIAL:                                      |  | DRAWN: <i>M. R...</i> | DATE: <i>11-13-77</i> | TANDBERG DATA, INC. <small>SAN DIEGO - CA</small> |                         |
| PROJECT ENGR: <i>...</i>                       |  | PROJECT: <i>...</i>   | DATE: <i>...</i>      | DWG TITLE                                         |                         |
| REMOVE ALL BURRS AND BREAK SHARP EDGES         |  | RELEASE: <i>...</i>   | APPROV: <i>...</i>    | MECH. ASSY- COMPLIANCE ARM                        |                         |
| FINISH:                                        |  | DO NOT SCALE DRAWING  |                       | MODEL NO.                                         |                         |
| GENERAL TOLERANCE: UNLESS OTHERWISE SPECIFIED  |  | PROJECTION:           | SCALE: <i>FULL</i>    | DWG SIZE: <b>D</b>                                | DWG NO. <b>11-10040</b> |
| UNIT: <i>[XXX] = INCH</i><br><i>[XXX] = MM</i> |  | SCALE: <i>FULL</i>    | CODE IDENT            | SHEET <i>1</i> OF <i>1</i>                        |                         |

| LTR | DESCRIPTION | DWG | APP |
|-----|-------------|-----|-----|
| A   | ECN # 1105  | VP  | VP  |

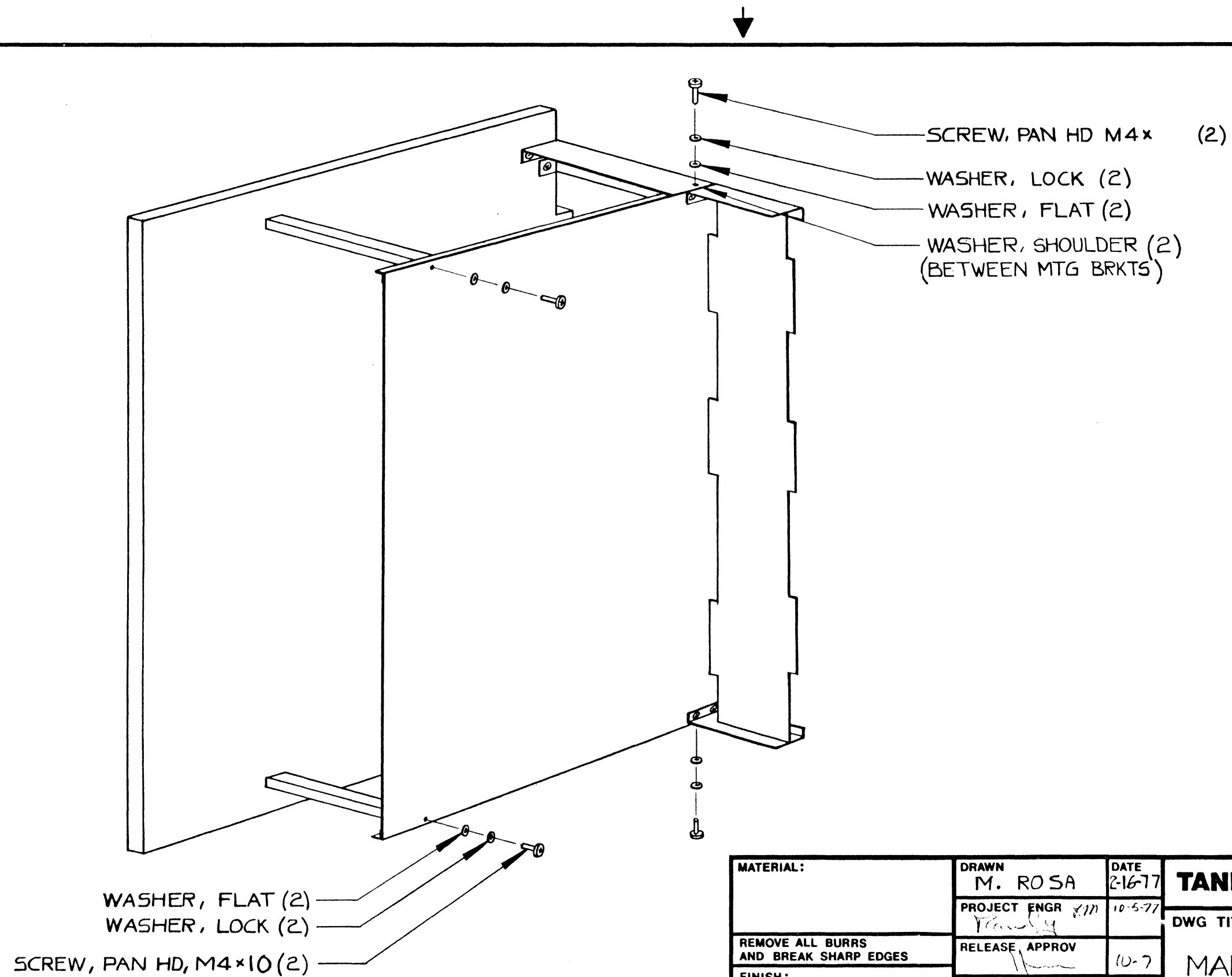


- 3 APPLY SMALL FILM OF LOCKTITE ON EITHER SIDE OF SHIM TO SECURE HEAD FROM MOVEMENT IN ADDITION TO SMALL AMOUNT ON SCREW THREADS.
- 2 ALIGN CROSSFEED SHIELD USING FIXTURE NO. \_\_\_\_\_
- 1 ALIGN TAPE CLEANER AND HEAD USING FIXTURE NO. \_\_\_\_\_ INSTALL GUIDE MP7 ON TOP OF TAPE CLEANERS USING SCREW H4 AFTER ALIGNMENT.

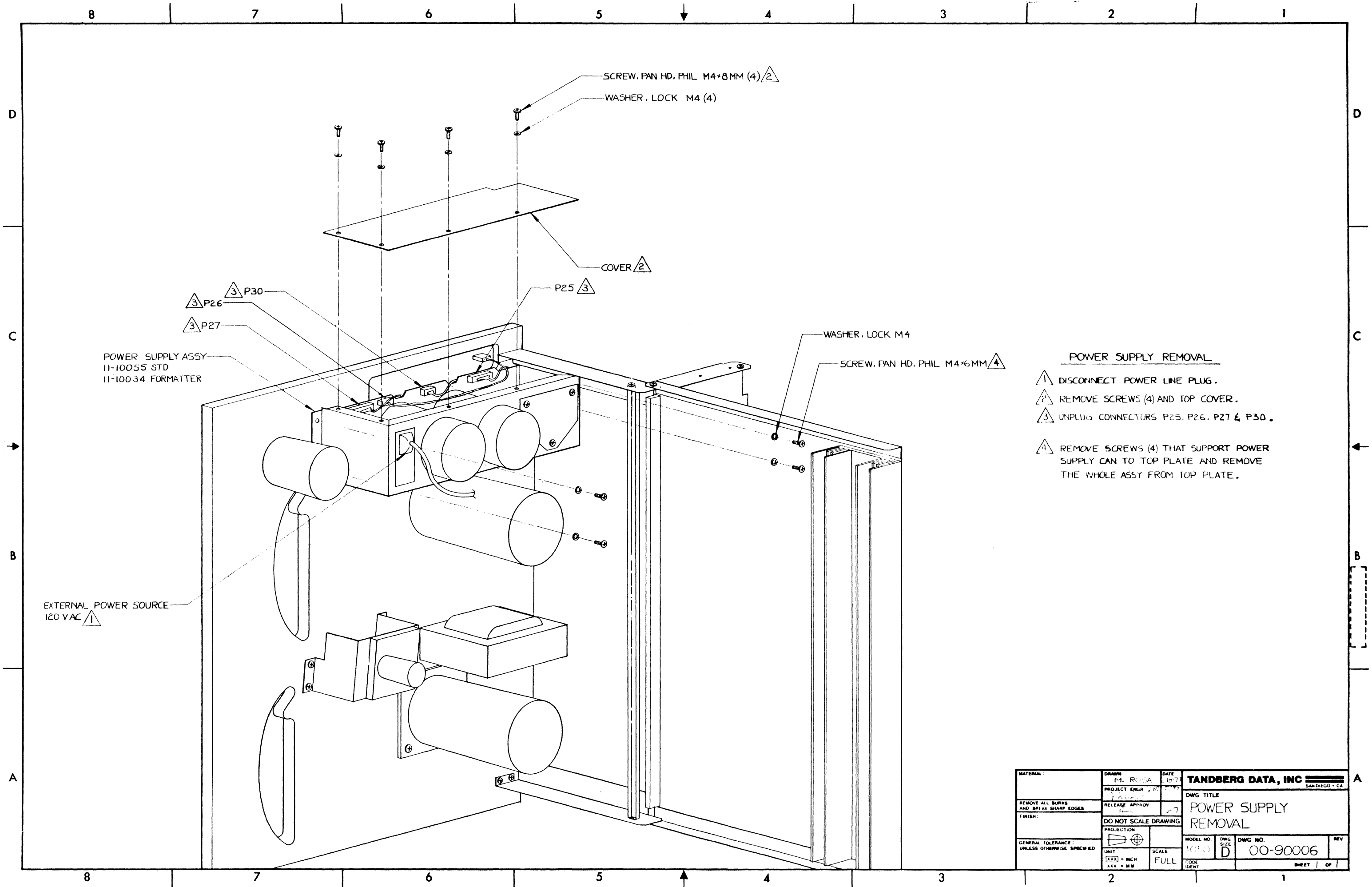
NOTES:

A112

|                                                |  |                                |              |                                    |  |
|------------------------------------------------|--|--------------------------------|--------------|------------------------------------|--|
| MATERIAL:                                      |  | DRAWN: M. ROSA                 | DATE: 3/1/77 | TANDBERG DATA, INC                 |  |
| PROJECT ENGR: J. B.                            |  | RELEASE APPROV: J. B.          |              | DWG TITLE: MECH. ASSY — HEAD PLATE |  |
| FINISH: REMOVE ALL BURRS AND BRUSH SHARP EDGES |  | DO NOT SCALE DRAWING           |              | MODEL NO. D                        |  |
| GENERAL TOLERANCE: UNLESS OTHERWISE SPECIFIED  |  | UNIT: 1/32" = INCH<br>XXX = MM |              | DWG NO. 11-10041                   |  |
| PROJECTION: 1st Angle                          |  | SCALE: 2 X                     |              | REV: A                             |  |
| CODE IDENT                                     |  | SHEET 1 OF 1                   |              |                                    |  |



|                                                  |                                    |                              |                                                            |                     |
|--------------------------------------------------|------------------------------------|------------------------------|------------------------------------------------------------|---------------------|
| MATERIAL:                                        | DRAWN<br>M. ROSA                   | DATE<br>2-16-77              | <b>TANDBERG DATA, INC</b><br><small>SAN DIEGO • CA</small> |                     |
|                                                  | PROJECT ENGR<br><i>[Signature]</i> | 10-5-77                      |                                                            |                     |
| REMOVE ALL BURRS<br>AND BREAK SHARP EDGES        | RELEASE<br><i>[Signature]</i>      | APPROV<br><i>[Signature]</i> | DWG TITLE<br>MAIN PCB REMOVAL                              |                     |
| FINISH:                                          | DO NOT SCALE DRAWING               |                              |                                                            |                     |
| GENERAL TOLERANCE:<br>UNLESS OTHERWISE SPECIFIED | PROJECTION<br>                     |                              |                                                            |                     |
|                                                  | UNIT<br>XXX = INCH<br>XXX = MM     | SCALE<br>1:4                 | MODEL NO.<br>1050                                          | DWG NO.<br>00-90005 |
|                                                  |                                    |                              | CODE IDENT                                                 | REV                 |
|                                                  |                                    |                              | SHEET 1 OF 1                                               |                     |



POWER SUPPLY REMOVAL

- 1 DISCONNECT POWER LINE PLUG.
- 2 REMOVE SCREWS (4) AND TOP COVER.
- 3 UNPLUG CONNECTORS P25, P26, P27 & P30.
- 4 REMOVE SCREWS (4) THAT SUPPORT POWER SUPPLY CAN TO TOP PLATE AND REMOVE THE WHOLE ASSY FROM TOP PLATE.

|                                               |  |                          |                       |                                   |                   |
|-----------------------------------------------|--|--------------------------|-----------------------|-----------------------------------|-------------------|
| MATERIAL:                                     |  | DRAWN: M. ROSA           | DATE: 12-77           | TANDBERG DATA, INC. SAN DIEGO, CA |                   |
| REMOVE ALL BURRS AND BREAK SHARP EDGES        |  | PROJECT ENGR: J. J. J.   | DATE: 12-77           | DWG. TITLE: POWER SUPPLY REMOVAL  |                   |
| FINISH:                                       |  | RELEASE APPROV: J. J. J. | DATE: 12-77           | MODEL NO. 10000                   |                   |
| GENERAL TOLERANCE: UNLESS OTHERWISE SPECIFIED |  | DO NOT SCALE DRAWING     | PROJECTION: 1st Angle | DWG. SIZE: D                      | DWG. NO. 00-90006 |
| UNIT: XXX = INCH, XXX = MM                    |  | SCALE: FULL              | CODE IDENT            | REV: 1                            |                   |





**SECTION X**  
**SERVICE BULLETINS / APPLICATION NOTES**

## SECTION X

### SERVICE BULLETINS/APPLICATION NOTES

#### 10.1 INTRODUCTION

This section is designed as a filing location for a continuing series of marketing and service bulletins designed to establish and maintain communications between Tandberg Data, Inc. and its customers and dealers.

These bulletins will be published as required. They will be sequentially numbered for easy identification and reference, and punched for a three ring loose-leaf binder.

APPENDIX A  
GLOSSARY

## APPENDIX A

### GLOSSARY OF TERMS

#### A

ALT . . . . . Arm Limit  
ANSI. . . . . American National Standard Institute

#### B

BOT . . . . . Beginning of Tape  
bpi . . . . . Bits per inch  
bpi-NRZI . . . . . Bits per inch-Non-Return to Zero-Inverted  
bpi-PE . . . . . Bits per inch-Phase Encoded  
BTS . . . . . Beginning Tape Status

#### C

CAPN. . . . . Capstan Normal  
CAPR. . . . . Capstan Rewind  
CER . . . . . Corrected error indication line  
CCG . . . . . Check Character Gate  
CMDI. . . . . Capstan Motor Driver Input  
COS± . . . . .  
CPU . . . . . Central Processing Unit  
CRCC . . . . . Cyclic Redundancy Check Character  
CRS . . . . . Clear Rewind Status  
CSA . . . . . Canadian Standards Association  
CWR . . . . . Clear Write Register

## GLOSSARY OF TERMS (CONTINUED)

D

|               |                         |
|---------------|-------------------------|
| DEC . . . . . | Density Command         |
| DEN . . . . . | Density                 |
| DES . . . . . | Density Status          |
| DDI . . . . . | Data Density Indication |
| DDS . . . . . | Data Density Select     |
| DIP . . . . . | Dual-in-line package    |

E

|               |                                                                                              |
|---------------|----------------------------------------------------------------------------------------------|
| ECMA. . . . . | Electronic Computer Manufacturers Association<br>European Computer Manufacturers Association |
| EIA . . . . . | Electronic Industries Association                                                            |
| ENB . . . . . | Enable                                                                                       |
| EOT . . . . . | End of Tape                                                                                  |
| ETS . . . . . | End of Tape Status                                                                           |

F

|                |                         |
|----------------|-------------------------|
| FAD . . . . .  | Formatter address line  |
| FPS . . . . .  | File Protect Status     |
| FRC . . . . .  | Fail-Safe Relay Command |
| FSR . . . . .  | Fail-Safe Relay         |
| FWC . . . . .  | Forward Command         |
| FWD . . . . .  | Forward                 |
| FWDA . . . . . | Forward Analog          |

G

|               |                       |
|---------------|-----------------------|
| GCR . . . . . | Group Coded Recording |
| GO . . . . .  | Motion Command        |

## GLOSSARY OF TERMS (CONTINUED)

### H

HATL . . . . . Half Arm Travel Limit  
HER . . . . . Hard error indication line  
HIDEN . . . . . High Density  
HIT . . . . . High Threshold

### I

IBG . . . . . Interblock Gap  
IBM . . . . . International Business Machine  
ID-Burst . . . . . Identification Burst  
I/O . . . . . Input/output  
IPS . . . . . inches per second  
ISO . . . . . International Standards Organization  
ISV . . . . . Instantaneous Speed Variations

### J

### K

### L

LED . . . . . Light Emitting Diode  
LDP . . . . . Load Point  
LODA . . . . . Load Analog  
LOL . . . . . Load On Line  
LOT . . . . . Low Threshold  
LRCC . . . . . Longitudinal Redundancy Check Character  
LSP . . . . . Low Speed Status

## GLOSSARY OF TERMS (CONTINUED)

### M

MET . . . . . Medium Threshold  
 MO . . . . . Motion  
 MUX . . . . . Multiplex

### N

NRS . . . . . NRZI Status  
 NRZ . . . . . NRZI mode indication  
 NRZI . . . . . Non-Return to Zero-Inverted

### O

OFC . . . . . Off-Line-Command  
 OFL . . . . . Off-Line  
 OLS . . . . . On-Line Status  
 ONC . . . . . On-Line Command  
 ONL . . . . . ON-Line  
 OVRWT . . . . . Overwrite  
 OVW . . . . . Overwrite

### P

PC or PCB . . . . . Printed Circuit Board  
 PE . . . . . Phase Encode  
 PEMO . . . . . Phase Encode Mode  
 PEMOA . . . . . Phase Encode Mode Analog  
 POCL . . . . . Power-On-Clear Pulse  
 PROM . . . . . Programmable Read Only Memory  
 PSU . . . . . Program Storage Unit

### Q

## GLOSSARY OF TERMS (CONTINUED)

### R

|                 |                                                        |
|-----------------|--------------------------------------------------------|
| RAM . . . . .   | Random Access Memory                                   |
| RDN . . . . .   | Retractor Down (Position)                              |
| RDO-7 . . . . . | Read Data Lines                                        |
| RDP . . . . .   | Read Data Parity                                       |
| RDS . . . . .   | Read Data Strobe                                       |
| RDS . . . . .   | Ready Status                                           |
| RDX . . . . .   | Ready                                                  |
| REC . . . . .   | Reverse Command                                        |
| REV . . . . .   | Reverse                                                |
| REVA . . . . .  | Reverse Analog                                         |
| RETMA . . . . . | Radio Electronics Television Manufacturing Association |
| RING . . . . .  | File Protect Ring                                      |
| ROM . . . . .   | Read-Only Memory                                       |
| RMR . . . . .   | Retractor Motor Run                                    |
| RRDY . . . . .  | Read Ready                                             |
| RRST . . . . .  | Read Reset                                             |
| RTH1 . . . . .  | Read Threshold 1                                       |
| RTH2 . . . . .  | Read Threshold 2                                       |
| RUP . . . . .   | Retractors Up                                          |
| RVP . . . . .   | Retractors Up )Position)                               |
| RSB . . . . .   | Read Strobe                                            |
| RWC . . . . .   | Rewind Command                                         |
| RWD . . . . .   | Rewind or Rewinding                                    |
| RWDA . . . . .  | Rewind Analog                                          |
| RWS . . . . .   | Rewind Status                                          |

### S

|               |                             |
|---------------|-----------------------------|
| SFC . . . . . | Synchronous Forward Command |
| SGL . . . . . | Single Gap                  |



## GLOSSARY OF TERMS (CONTINUED)

### S (Continued)

|                |                             |
|----------------|-----------------------------|
| SLT . . . . .  | Select                      |
| SMDI . . . . . | Supply Motor Drive Input    |
| SRC . . . . .  | Synchronous Reverse Command |
| STPA . . . . . | Stop Analog                 |
| SWD . . . . .  | Set Write Data              |
| SWR . . . . .  | Set Write Register          |
| SWS . . . . .  | Set Write Status            |

### T

|                |                            |
|----------------|----------------------------|
| TAD . . . . .  | Transport Address Line     |
| TH . . . . .   | Threshold                  |
| TK . . . . .   | Track                      |
| TMDI . . . . . | Take-Up Motor Driver Input |
| TRD . . . . .  | Test Read                  |
| TRK . . . . .  | Track                      |
| TWD . . . . .  | Test Write Data            |
| TWS . . . . .  | Test Write Strobe          |

### U

|               |                               |
|---------------|-------------------------------|
| UL . . . . .  | Underwriters Laboratory, Inc. |
| ULP . . . . . | Unload Position               |

### V

### W

|                |                    |
|----------------|--------------------|
| WARS . . . . . | Write Reset Status |
| WD . . . . .   | Write Data         |
| WDC . . . . .  | Write Data Command |

## GLOSSARY OF TERMS (CONTINUED)

W (Continued)

|       |   |   |   |   |                      |
|-------|---|---|---|---|----------------------|
| WDO-7 | . | . | . | . | Write Data Lines     |
| WDP   | . | . | . | . | Write Data Parity    |
| WDS   | . | . | . | . | Write Data Strobe    |
| WEC   | . | . | . | . | Write Enable Command |
| WRC   | . | . | . | . | Write Reset Command  |
| WRS   | . | . | . | . | Write Reset          |
| WRT   | . | . | . | . | Write Enable         |

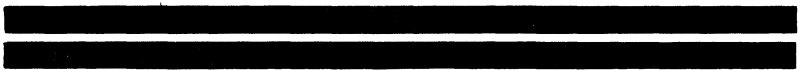
XYZ

\*\*\*\*

**TANDBERG**

**APPENDIX B  
CUSTOMER OPTIONS**

# TANDBERG



## APPENDIX C TDF FORMATTER